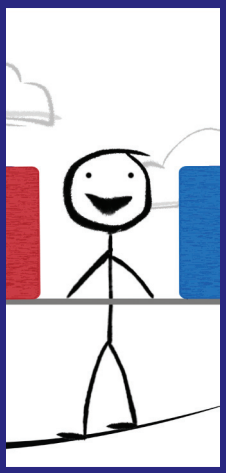
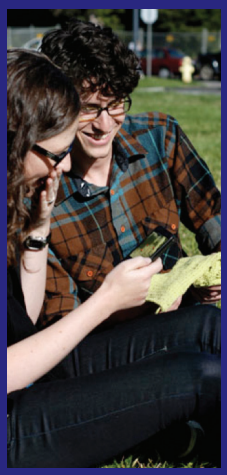
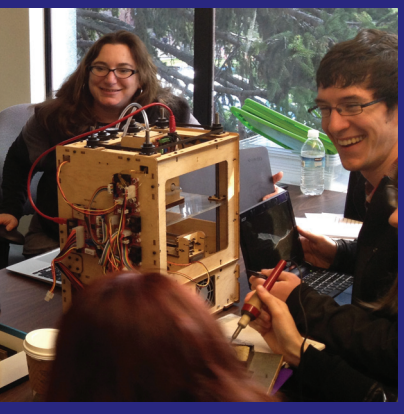
Explorations

2013 Faculty Research Review

Department of Human Centered Design & Engineering
University of Washington, Seattle







HCDE Human Centered Design & Engineering
University of Washington

Message from the Chair

The Department of Human Centered Design & Engineering (HCDE) has continued its remarkable growth over the last year. This year Gary Hsieh and Daniela Rosner joined HCDE as Assistant Professors, and Linda Wagner joined as a Senior Lecturer. The growth of our faculty enables us to expand our offerings and serve more students, with nearly 400 students now seeking degrees and certificates from Human Centered Design & Engineering. Unfortunately, Professors Judy Ramey and David Farkas will be retiring this year. While we are sad to see them go, we are grateful for their years of service to the department and to the University of Washington.

Our Corporate Affiliates Program, now in its third year, continues to be successful in encouraging industry partnerships. Our faculty and students are working closely with our Corporate Affiliate partners in research and class projects, and many of our students go on to receive employment from our affiliates.

This third issue of *Explorations* describes research agendas of HCDE faculty and their students this past year. Professor Cecilia Aragon has been focusing on information visualization and visual analytics for eScience, collaborative creativity in educational games, and usability in daily life. Professor Cindy Atman has been conducting research to advance engineering education and engineering design processes. Professor Mark Haselkorn has been examining healthcare informatics with a goal of improving cognitive processes and workflows of users and raising the productivity and quality of healthcare.

Professor Gary Hsieh recently joined the department, and his research focuses on understanding, designing, and developing motivators that encourage people to communicate and interact in ways that are self- and welfare-improving.

Professor Julie Kientz has been researching how to help parents and healthcare providers detect developmental delays in children, and how to improve sleep behavior and learning. Professor Beth Kolko has been exploring how technologists, social scientists, and scholars collaborate on technology-related development projects. Professor Charlotte Lee has been developing a framework to understand the socio-technical relationships that comprise cyberinfrastructure, investigating the role of coordinating centers in collaborative cancer-epidemiology studies.

Professor Sean Munson has been designing, building, and evaluating systems designed to nudge people toward socially desirable outcomes while respecting individual autonomy, and he has been researching exposure to political diversity online and the use of social software for health and wellness.

Professor Daniela Rosner also joined the department recently, and her research combines design, computing, and fieldwork to reveal the social conditions and cultural values that shape and are shaped by digital technology.

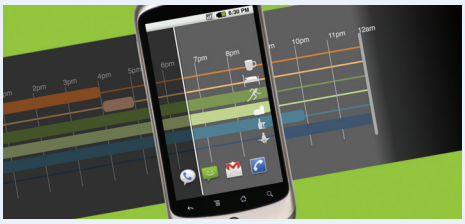
I have been researching how the design of information affects the user experience with online information, and working with a student team to make *WebLabUX* (a remote user research toolkit) into an open source product. Professor Kate Starbird has been focusing on the use of social media during crises and mass emergencies, and specifically examining how digital volunteers and other members of the connected crowd help to organize information during disasters. Professor Michio Tsutsui has been examining effective feedback and reinforcement of correct usage forms through computer-assisted, language learning materials. Professor Jennifer Turns has been studying the educational significance of asking engineering students to construct portfolios. Professor Mark Zachry has been exploring how people use digital technologies to engage in knowledge work and developing tools to understand these activities and inform the design of new systems.

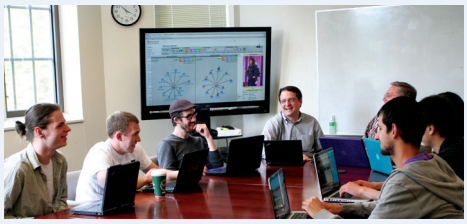
I hope you find this third issue of *Explorations* as enjoyable as I have. You can learn more about our faculty research and our department on our website, hcde.uw.edu.

Happy Reading,

Jan Spyridakis

Professor and Chair,
Human Centered Design
& Engineering





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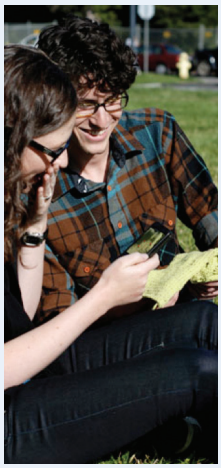
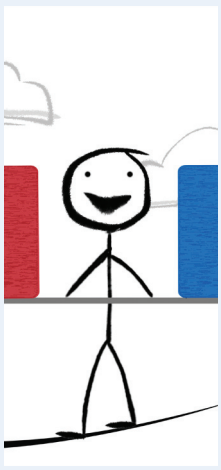




Scientific Collaboration and Creativity

Cecilia Aragon

Dr. Cecilia R. Aragon is an Associate Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Scientific Collaboration & Creativity Lab (SCCL).

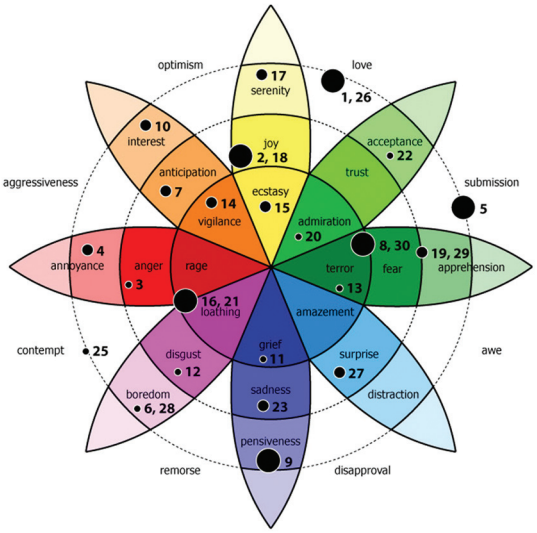
Collaborative Creativity in Scientific Research and Educational Games

What do astrophysicists operating a large telescope remotely and children building computer games collaboratively have in common? How do we design interfaces to facilitate creativity in groups? And can games be used to effectively teach students cyberinfrastructure and computing concepts?

In SCCL, Cecilia Aragon and her students use visualization, machine learning, and qualitative techniques to study collaborative scientific creativity and how emotion is involved in the process. By doing so, they hope to find answers to the questions mentioned above. Their projects involve dynamic affect detection in chat logs, Twitter, and other social media, visualization of large scientific and social data sets, usability in daily life, and the development of collaborative games to engage young people in STEM concepts.

Collaborative Creativity

Creativity is arguably humanity's supreme achievement. Contrary to the popular belief of the "aha" moment of insight, recent work has indicated that creativity is often a series of incremental steps to discovery. As an idea is developed, it is amplified over time in its social context. Aragon and her colleagues are developing and evaluating a dynamical systems theory of collaborative creativity based on distributed affect and interfaces that facilitate socio-emotional communication. This theory is based on studies performed at three field sites comprising astrophysicists, children building computer games online, and engineers at a multinational company.



A visualization of the affect codes applied to Plutchick's Wheel of Emotion. The size of the circles represent the number of times each emotion occurred in the manually coded logs.

Dynamic Affect Detection in Collaboration Chat Logs

Geographically distributed collaborative teams frequently rely on text-based communication for social and task-oriented interactions between team members. Better understanding of affect expression in synchronous text-based communication of such collaborations could lead to many benefits, including improvements in team dynamics and productivity. However, automated detection of affect in text, although the subject of much previous research, is difficult.

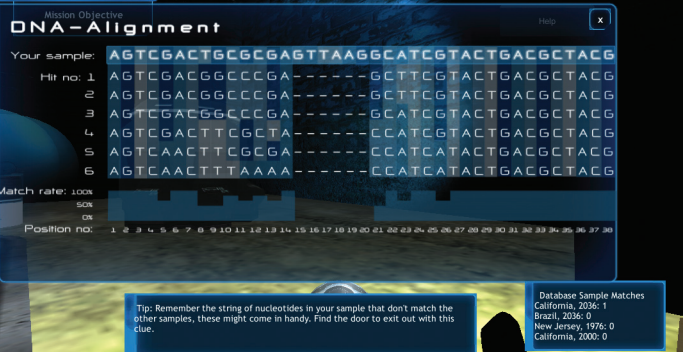
SCCL presents a new method of analyzing affect in large-scale electronic communications, utilizing a visual analytics pipeline involving a combination of interactive visual interfaces, natural-language processing, and machine learning techniques. Their approach is based on an interpretation of affect as a dynamic process, and utilizes multiple independent classifiers to recognize different types of affect. They have applied this method to four years of chat logs from a longitudinal study of a multi-cultural distributed scientific collaboration. Using ground truth affect labels generated by a group of human coders, this approach can successfully identify many commonly-occurring types of affect in the chat logs. Building on this work, SCCL has been developing a collaborative visual analytics tool for exploring emotion and sentiment in Twitter. This allows teams of researchers to uncover emotional events and generate hypotheses about Twitter data sets, as part of the early phase of analysis. SCCL plans to continue improving the system and release it for general use.

Usability in Daily Life

Usability and Security

Do you remember all your passwords? Have you ever forgotten a password or written it down?

Accurate, non-intrusive, and unforgeable identity recognition for desktop and online applications is an area of increasing concern to just about everyone in today's networked world, with the need for security set against the goals of easy access. It is clear that password verification has major flaws in multiple areas, including usability, accuracy, and security. Aragon and her students are developing an *eye-tracking digital signature*, a method for biometric identification that combines physiological and behavioral traits and is grounded in a mathematical model of the muscles of the eye globe. They are conducting usability tests of the interface to this biometric technique in common applications. This research is funded by the National Institute of Standards and Technology.



A bioinformatics visualization tool to compare nucleotide sequences in the game *Max5*.

Thermostat Usability

Residential thermostats control about 10% of national energy use. In 1995, the Energy Star Program established technical specifications for "energy saving" programmable thermostats. Many building codes and government programs now require installation of programmable thermostats because of their assumed energy savings. However, in 2008, Energy Star concluded that homes with programmable thermostats were using *more* energy than homes with manual thermostats.

As a result, Energy Star terminated the thermostat endorsement program in 2009 and decided that any future endorsement program must include specifications for minimum levels of usability. Aragon and her colleagues and students performed multiple lab and field studies of thermostats and developed an innovative usability metric for thermostats to facilitate energy saving behavior. This metric is currently being evaluated in Energy Star's draft specifications for programmable thermostats. This work is funded by the US Department of Energy.

Collaborative Games for Bioinformatics Education

This project leverages recent research into the socio-emotional mechanics of online collaboration and multiplayer game development, and the existing social networking structure of *BuddyPress*, to create an educational game that incorporates bioinformatics and cyberinfrastructure concepts aimed at high school students. SCCL is interested in the uptake of concepts of cyber problem solving specifically among young underrepresented minorities and women, and the production of conceptual models that will help them to better understand the larger relationships between people, educational games, and infrastructural computational technologies. Collaboration and creative strategies will be encouraged and integrated into the gameplay mechanics.

Max5 is a game based around a futuristic crime scene investigation scenario in which players must collaborate in teams and take on the roles of forensics experts, computing experts, and scientists to solve clues and recover data from a top-secret research project gone awry. The game integrates bioinformatic concepts with programming hacks, where players can use real code to modify game objects and character behavior. You can track the game's latest updates at gamestem.com.

Aragon and her students have built partnerships with highly diverse Seattle area public schools and have involved student designers in every aspect of game design, development, and testing.

A player explores a mountainous region, gathering clues regarding an influenza outbreak and sharing information with other players in *Max5*.

More Information

Cecilia Aragon is an Associate Professor in the Department of Human Centered Design & Engineering and a member of the eScience Institute at the University of Washington. She directs the Scientific Collaboration & Creativity Laboratory.

Previously, she was a computer scientist at Lawrence Berkeley National Laboratory for six years, after earning her PhD in Computer Science from UC Berkeley in 2004. She earned her BS in Mathematics from the California Institute of Technology.

She and her students develop collaborative visual analytics tools to facilitate data science, and study current scientific practice around large and complex data sets. Her research interests span human-computer interaction, computer supported cooperative work, visual analytics, information visualization, scientific collaborations, usability and sustainability, collaborative games, distributed creativity, distributed affect, social media, and new methods of computer-mediated communication. In 2009, she received the Presidential Early Career Award for Scientists and Engineers for her work in collaborative data-intensive science.

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Max Five gamestem.com

Understanding Engineering Learning and Design Expertise

Cynthia Atman

Dr. Cynthia J. Atman is a Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Center for Engineering Learning & Teaching (CELT).

Cynthia Atman's research focuses on engineering design learning and students as emerging engineering professionals. Through CELT, Atman works with colleagues at the University of Washington (UW) and across the nation to advance engineering education.

CELT Leadership

CELT supports the UW College of Engineering's mission by taking a leadership role in engineering education, both within the university and as the UW's representative among engineering education researchers and policy-makers around the world.

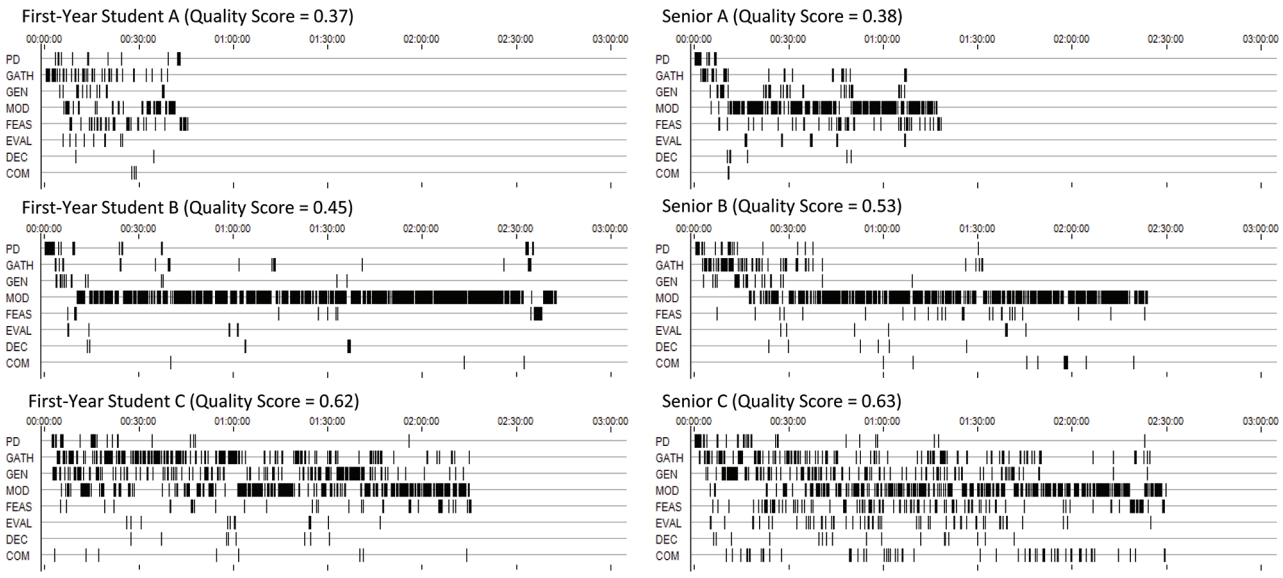
CELT focuses on two synergistic activities: research on engineering education and improving engineering teaching through a wide range of instructional development programs. This dual-role structure is based on an awareness that a solid engineering education research base is needed to inform educators about how their students learn, and that this research should drive and support effective teaching. Since 1998, CELT's model has proven successful in the College of Engineering and has had an impact on engineering education at national and international levels.

Research on Engineering Design

Atman's research examines how engineering students and practicing professionals solve engineering design problems, as well as the effectiveness of current approaches to engineering design instruction. The broad goal is to more closely align the outcomes of engineering education with the needs of engineering practice. Atman's research includes innovative methods for representing engineering design processes and detailed analyses of undergraduate engineering students' design abilities and how they develop during their academic careers.

Analysis and Representation of Design Processes

For over two decades, Atman has led empirical studies of engineering students' and professionals' approaches to open-ended design problems. Her design process timelines provide a compact but detailed representation of the many different activities involved in the design process. These timelines and the other representations have proven to be valuable tools for researching and teaching students about design processes. Current work includes augmenting the visual representations with multimedia and presenting processes as brief audio clips synchronized with timeline animations.



Class Exercise: In the design process timelines above, students were asked what similarities and differences they saw between the first-year and senior engineering students.

Legend: PD: Problem Identification; GATH: Information Gathering; GEN: Generation of Ideas; MOD: Modeling; FEAS: Feasibility of Analysis; EVAL: Evaluation; DEC: Decision; COM: Communication

Comparisons of Student and Expert Designers

Atman and her research team have analyzed how novice and expert engineers solve open-ended design problems. Both solutions and design processes have been compared across three groups: beginning undergraduate engineering majors, graduating majors, and practicing professional engineers. Methods including the timeline analyses have led to a detailed understanding of the development of design skills, including the following findings:

- Engineering experts distinguish themselves from undergraduates in the effectiveness of their problem scoping, how much problem-relevant information they gather, and time spent on a wide range of design activities (e.g., generating and evaluating solution ideas).
- Graduating engineering majors are, as expected, more similar to experts than beginning majors are, with respect to design process and solution quality.

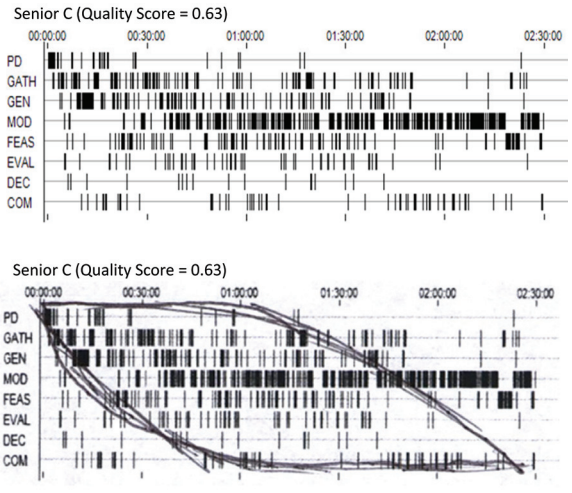
CELT has collaborated with engineering instructors to improve student awareness of the components, complexities, and benefits of well-planned, well-executed engineering design processes. Students in one class exercise were asked to examine a set of first-year student and senior student design activity timelines (see facing page) and to tell CELT what they found.

Selected Student Insights

"Problem definition is key to the overall project. Remind yourself of what you are doing and what is really being asked. Pick your head up from the paper (Modeling) and analyze the problem."

"Realization of how the design process moves from one portion to the other was the best aspect of this talk. I didn't realize how important the reiteration of certain aspects of the process [are]."

Another student compared the "Graduating Senior" timeline (below) to those of other students and concluded that an effective design process might be characterized as having a particular shape that he labeled an "Ideal Project Envelope." The "Ideal Project Envelope" is something CELT researchers previously identified and termed a "cascade pattern," seen most often in experts' timelines. This pattern contains a full range of design activities and suggests a way of moving through those activities over time.



Top Figure: Design Process Timeline. Bottom Figure: "Ideal Project Envelope."

Legend: PD: Problem Identification; GATH: Information Gathering; GEN: Generation of Ideas; MOD: Modeling; FEAS: Feasibility of Analysis; EVAL: Evaluation; DEC: Decision; COM: Communication

More Information

Photo: Mary Levin

Cynthia J. Atman is a Professor in the Department of Human Centered Design & Engineering, founding Director of the Center for Engineering Learning & Teaching (CELT), and the inaugural holder of the Mitchell T. & Lella Blanche Bowie Endowed Chair at the University of Washington. She also directed the Center for the Advancement of Engineering Education (CAEE), an NSF-funded, $12 million center that was active until 2010.

Atman earned her PhD in engineering and public policy from Carnegie Mellon University and joined the University of Washington in 1998 after seven years on the faculty at the University of Pittsburgh.

Her research in engineering education focuses on engineering design learning with a particular emphasis on issues of design context. She is a fellow of the American Association of the Advancement of Science and the American Society for Engineering Education (ASEE), was the 2002 recipient of the ASEE Chester F. Carlson Award for Innovation in Engineering Education, and received the 2009 David B. Thorud Leadership Award from the University of Washington.

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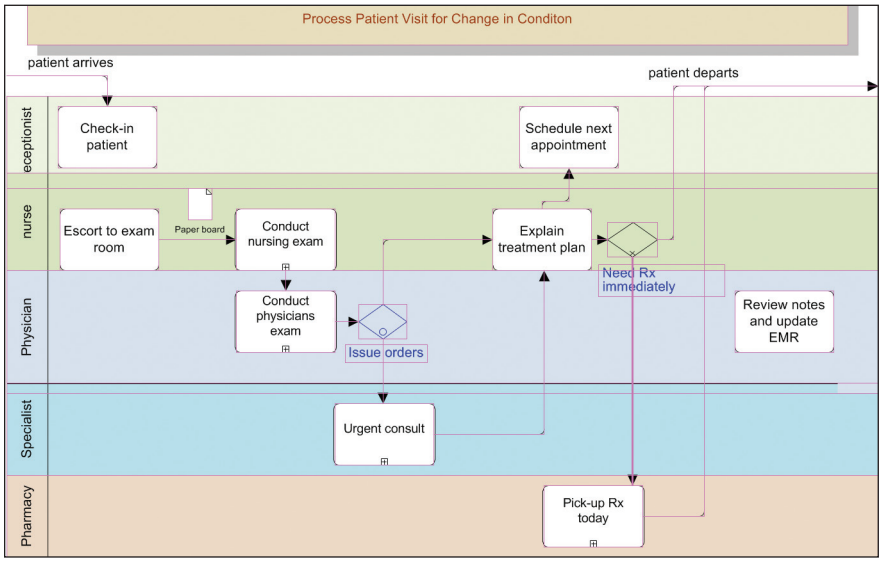
Evidence-based Healthcare Informatics

Mark Haselkorn

Dr. Mark Haselkorn is a Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Pacific Rim Visualization and Analytics Center.

Mark Haselkorn continues his work on the design of health information systems that will improve the cognitive processes and workflows of its users, and measurably raise the productivity and quality of clinical care. The project is now funded by the Agency for Healthcare Research & Quality (AHRQ), and is in the second of a four-year award. Dr. Keith Butler is PI on this project (see facing page).

In addition, Mark's team, which includes graduate students Melissa Braxton, Andrew Berry, and Christina Chung, has received an award from the University of Washington Center for Commercialization (C4C) to forward the commercialization of *MATH*, a software tool suite for generating system enhancements that "build-in" measurably superior care workflows to the design of health information systems. *MATHflow* extends the Object Management Group's standard for business process modeling with editors and dictionaries for information modeling, facilitating the capture of the flow of information needed to support improved workflow. *MATHview* imports the dictionary and translates information flow into key software artifacts, such as an information architecture, which can be imported to the Unified Modeling Language for technical analysis and design of the software. *MATHsim* supports simulation and analysis of captured work and information flow models. The C4C award supports a pilot study of *MATH* conducted with the Veterans Health Administration.



MATH is a software tool suite for "building-in" measurably superior care workflows to the development of health information technology systems.

Need

There is critical, nationwide need to improve healthcare and access to it while reducing its cost. Health information technology (HIT) has great promise, but the adoption rate of electronic medical records is less than 15% by private providers. Healthcare leaders have serious concerns about disrupting the workflow of clinical care, increasing treatment errors, excessive training and tech support, and steep startup costs.

Modern healthcare must be coordinated over time and across specialty organizations that provide for many patients. Medicine is information-intensive work that spans the tasks of individuals, small teams, and different organizational processes. Patients, themselves, are increasingly important participants in healthcare. One of the fundamental ways that HIT must serve to improve healthcare is by enabling workflows across boundaries that are far more coherent and understandable, which are keys to safety, efficiency, timeliness, and equity.

Situation

Conventional HIT development is feature-based and treats workflows as responses to the HIT that will eventually emerge after deployment. Given their large startup cost and unpredictable impact, the decision to invest in HIT is often seen as too risky. Haselkorn's team is working to make HIT design evidence-based, serving as a reliable means to implement the policies of healthcare leaders and private clinics, such as increasing the productivity and quality of the care they provide, or reducing administrative overhead.

Approach

Like many artifacts of clinical care, workflows can be designed and validated with objective evidence. Recent scientific research has clarified the principles for the way information drives the decision-making and work-

flows of clinical care [1–4]. Putting the healthcare providers at the center of the design process, these principles can be exploited to make improved workflow a planned part of HIT development. Information flow and workflow can be developed as a pair of matched designs. When the workflow is measurably more efficient and/or of better quality, HIT development can become evidence-based instead of feature-based.

Benefits

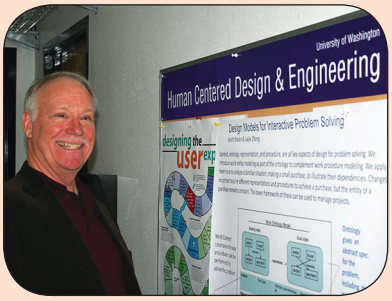
The current situation creates pent-up demand and tremendous opportunity for evidence-based HIT systems. HIT adoption rates will increase as healthcare leaders can participate in concept design, understand what they are paying for, and have the visibility of progress they need to direct investment.

1 V.L. Patel and J. Zhang, "Cognition and patient safety," in F. Durso, R. Nickerson, S. Dumais, S. Lewandowsky, and T. Perfect, eds., *Handbook of Applied Cognition*, 2nd ed. (New York: Wiley, 2006).

2 J. Zhang, "Human-centered computing in health information systems: part I—analysis and design," *Journal of Biomedical Informatics* 38 (2005), 1–3.

3 V.L. Patel, J. Zhang, N.A. Yoskowitz, R. Green, and O.R. Sayan, "Translational cognition for decision support in critical care environments: a review," *Journal of Biomedical Informatics* 41:3 (2008), 413–431.

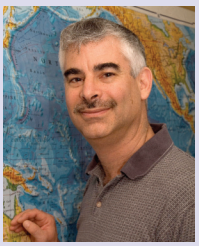
4 K.A. Butler and J. Zhang, "Design models for interactive problem-solving: context & ontology, representation & routines," in *Proceedings of ACM CHI 2009 Conference on Human Factors in Computing Systems* (2009).



Keith Butler, Principal Research Scientist, Department of Human Centered Design & Engineering, has been collaborating with Haselkorn on this research.

Butler is Co-PI at the National Center for Cognitive Informatics & Decision Making. He has been a Director of User Experience at Microsoft and a Boeing Technical Fellow in Math & Computing Technology, where he was responsible for the core technology area of human-computer interaction. He completed his PhD in cognitive psychology at Tufts University in 1980 and began working at Bell Telephone Labs, where he developed user-centered methods and prototypes for maintenance information systems. Working with John Bennett and John Whiteside, he was one of the originators of Usability Engineering. He is past chair for the ACM conference on computer-human interaction (SIGCHI), and currently serves on the steering committee for software product usability for the US National Institute for Standards & Technology.

More Information



Mark Haselkorn is a Professor in the Department of Human Centered Design & Engineering. Haselkorn leads University of Washington (UW) partnerships in the National Center for Cognitive Informatics & Decision Making in Healthcare, funded by the Office of the National Coordinator for Health Information Technology, as well as the Center of Excellence on Visual Analytics for Command, Control, and Interoperability Environments, funded by the Department of Homeland Security.

He is Director of the Pacific Rim Visualization and Analytics Center, which has the mission of advancing visual analytics for the enhancement of distributed, collaborative cognition and decision-making for public safety and security. He also founded and directs the UW's Interdisciplinary Program on Humanitarian Relief, a cross-campus program of research and education that works with the international humanitarian sector to improve logistics and service systems. In this area, one of Haselkorn's current PhD students, Robin Mays, has received a three-year National Science Foundation Graduate Fellowship (2012–2016).

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Tailoring Motivators for Prosocial Computing

Gary Hsieh

Dr. Gary Hsieh is an Assistant Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Prosocial Computing Laboratory.

Information and communication technologies hold great promise in promoting and empowering prosocial actions, such as sharing, donating, cooperating, and volunteering. Unfortunately, while continued advances in technologies can help lower barriers and increase the efficacy of prosocial behaviors, the fundamental challenge of motivation persists—people still need to have the desire to help others. Gary Hsieh and his research team aim to study, design, and build technology-mediated motivators to facilitate prosocial behaviors.

Understanding People's Motivations

People are not homogenously motivated. Just because two people both volunteer, it does not mean that they do it for the same reasons. For example, one may volunteer because of altruism, but another may be doing it to make friends and meet people. To more effectively encourage prosocial behaviors from *everyone*, Hsieh and his research team must gain a better understanding of why they do or do not participate in activities like volunteering.

One area of Hsieh's research focuses on understanding volunteers in online communities. Specifically, Hsieh and his research team have examined volunteers who help newcomers become familiar with the practices and attitudes of their community, which then contributes both to the community's growth and its establishment. Their research focuses on identifying who those people are and what motivates them to play this role. Through a survey of more than 1,000 Reddit users and analyses of their usage data, Hsieh and his team developed a newcomer socialization scale, and found that generalized reciprocity, social identity, and prosocial orientations were all significant predictors of whether people voluntarily helped newcomers.[1] They plan to expand their research to other online communities in order to better understand how volunteer socializers differ across various types of communities. This will lead to better analytical tools to assess the "health" of a community and help motivate people to become volunteers in their communities to assist others.

Another area of Hsieh's research studies the use of technologies for civic activism. Increasingly, social technologies are used for various forms of activism, such as fundraising, community building, lobbying, and organizing. Yet, despite its potential to reach people and raise large-scale awareness, critics argue that this "slacktivism" may hurt real activism. For example, by simply clicking on the "like" button on the American Red Cross Facebook page, people may feel that they have already supported a good cause and feel justified to refuse a subsequent request for help (the moral balancing effect). This argument, however, overlooks the potentially counteracting effect due to one's desire for cognitive consistency; performing low-cost activism may actually increase people's compliance in subsequent requests.

Hsieh and his research team are conducting a series of online experiments to test whether signing an online petition would influence subsequent contribution to a charity.[2] Their current findings show promise in leveraging people's desire for consistency to help transition them from performing low-cost activism to other, more "costly" types of civic actions.

Designing Tailored Motivators

Due to heterogeneity, Hsieh cannot employ a "one size fits all" design to motivate prosocial behaviors. Otherwise, not only are the motivators ineffective, they may also undermine diversity by attracting only a subset of potential users to participate (see Figure 1). Part of his research focuses on how to infer individuals' motivation and to design the appropriate motivator.

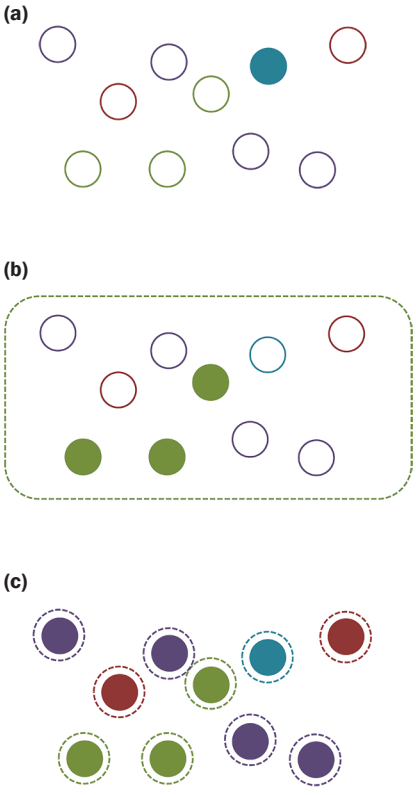

Figure 1. **(a)** Without motivators, less than 5% of users contribute in social technologies. **(b)** Generalized motivators may appeal to only certain types of people. **(c)** Tailored motivators appeal to individual users' values and needs; increase quantity and diversity of participation.

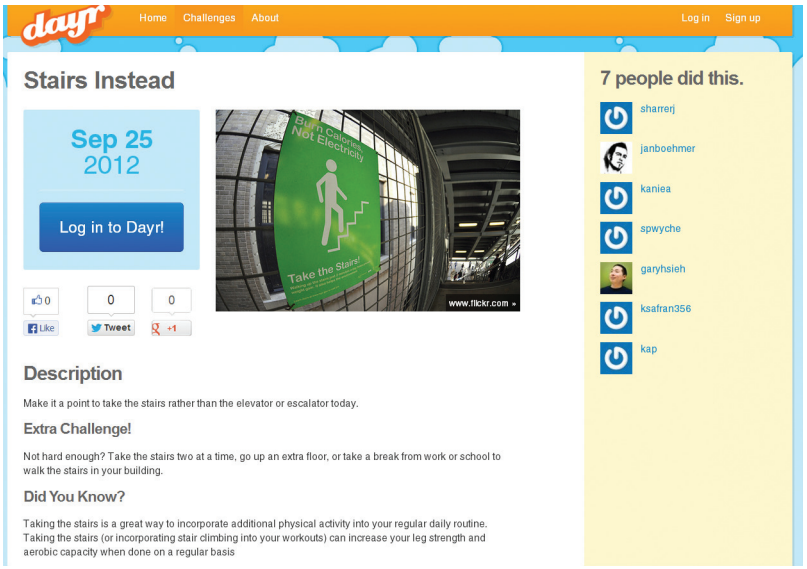

Figure 2. The current iteration of a challenges-based behavior change site—*Dayr*.

Collaborating with researchers at IBM, his initial work has demonstrated that individuals' personal values correlate with a number of behaviors on social technologies. For example, those who value achievement more frequently used work-related words in an online community, while those who hold self-transcendent values were more likely to focus on others. The observable link between values and behaviors shows promise that Hsieh and his team may one day be able to infer individuals' motivational values through our participations in social technologies.

At the same time, advances in technologies have enabled the development of a plethora of technology-mediated motivators, such as badges, gifts, virtual presents, and financial rewards. But they have only begun exploring what is possible. Hsieh's research attempts to integrate behavioral theories to develop novel motivators that can be tailored to individuals appropriately.

Building Behavior Change Tools

Therefore, to integrate his findings and novel motivators, Hsieh is also developing a suite of behavior change tools. These tools will facilitate the breakdown of long-term goals into daily challenges and utilize novel motivators to support and sustain participation. In addition, through community-based features, he will create an online community where people can share general and domain-specific behavior change information and support (see Figure 2).

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1 G. Hsieh, Y. Hou, I. Chen, and K. N. Truong, "Welcome!: social and psychological predictors of volunteer socializers in online communities," in *Proceedings of the 2013 conference on Computer supported cooperative work* (2013), 827–838.

2 Y. H. Lee and G. Hsieh, "Does slacktivism hurt activism?: the effects of moral balancing and consistency in online activism," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (2013), 811–820.

More Information

Gary Hsieh is an Assistant Professor of Human Centered Design & Engineering at the University of Washington and Director of the Prosocial Computing Laboratory. His research focuses on studying, designing, and developing technologies that enable people to interact in ways that are efficient and welfare-improving. He was previously an Assistant Professor in Communication and Information Studies at Michigan State University and has conducted research at multiple industry research labs, including Microsoft, IBM, Intel, and Fuji-Xerox. He received his PhD from the Human-Computer Interaction Institute at Carnegie Mellon University and his BS in Electrical Engineering and Computer Science at the University of California, Berkeley. He is also a recipient of the National Science Foundation Career Award.

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Computing for Healthy Living

Julie Kientz

Dr. Julie A. Kientz is an Assistant Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Computing for Healthy Living & Learning Laboratory.

Julie Kientz and her students design, develop, and evaluate applications to support individuals and families in pursuing their health goals. They explore how novel technologies, such as ubiquitous and collaborative computing, can help with record-keeping, data review, and behavior change. The main research focuses on applications for healthy living and new approaches to doing research in this space.

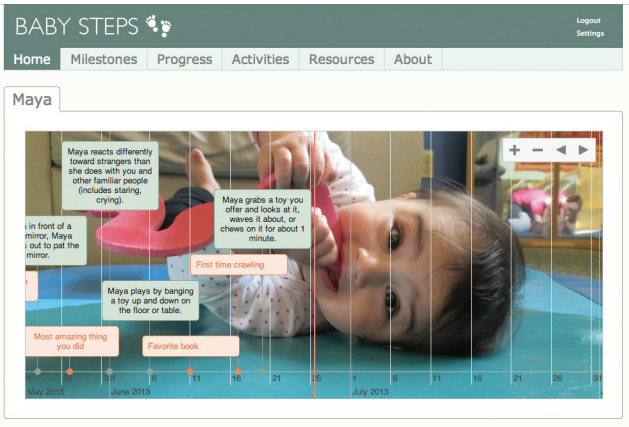
Applications for Healthy Living

Kientz and her students design technologies to support preventive healthcare and help individuals try to meet their goals for health on their own and in collaboration with their doctors. The main projects in this space are *Baby Steps*, supporting healthy sleep behaviors, autism therapy, and *Eyes-Free Yoga*.

Baby Steps

In *Baby Steps*, Kientz and her research group are designing a suite of technologies to help detect, record, and track developmental progress in children during their first five years. They aim to help parents and healthcare providers detect developmental delays such as autism or emotional disorders earlier, which can improve the effectiveness of interventions. Recent work by PhD students Alexis Hiniker, Hyewon Suh, and John Porter has focused specifically on adapting technology for underserved populations and using SMS, Twitter, and the web for tracking milestones. This work is sponsored by the National Science Foundation on a Faculty Early Career Development grant.

ShutEye was developed by Kientz and her students to promote good sleep hygiene.



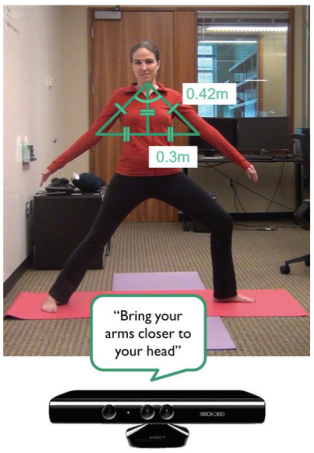
Baby Steps helps detect, record, and track developmental progress in children during their first five years.

Healthy Sleep Behaviors

Sleep is a key aspect of health, yet relatively underemphasized compared to diet and exercise. Kientz is exploring how ubiquitous computing can help play a role in influencing sleep behaviors, aiding in the diagnosis of sleep disorders, and promoting good sleep hygiene. She and her PhD students Eun Kyoung Choe, Matt Kay, and Jared Bauer have developed several mobile phone applications (*ShutEye*, *SleepTight*, and *PVT-Touch*) and a sensor-based capture and access application (*Lullaby*) for exploring the sleep environment. This work is in collaboration with the University of Washington Sleep Center and the School of Nursing.

Autism Therapy

Kientz has developed a software tool, *Abaris*, which supports therapists and teachers who perform Discrete Trial Training therapy, a current best practice intervention for children with autism. The system uses pen, speech, and video indexing to help improve access to data and aspects of decision-making. She is also working with HCDE PhD student



Kientz and her PhD student, Kyle Rector, have been working in the space of designing new tools to help improve accessibility for individuals with disabilities. The first project in this space, called *Eyes-Free Yoga*, uses the Microsoft Kinect to allow people who are blind or low vision to receive audio-based corrections while doing different Yoga poses.

Alexis Hiniker on the evaluation of tablet-based games for autism therapy.

Eyes-Free Yoga

Individuals with disabilities are far less likely to engage in physical activity due to a number of accessibility barriers. Kientz and her PhD student, Kyle Rector, have been working in the space of designing new tools to help improve accessibility for individuals with disabilities. The first project in this space, called *Eyes-Free Yoga*, uses the Microsoft Kinect to allow people who are blind or low vision to receive audio-based corrections while doing different Yoga poses. An evaluation with 16 blind or low vision individuals indicated that this tool could help give people the confidence to try new exercise classes.

New Approaches

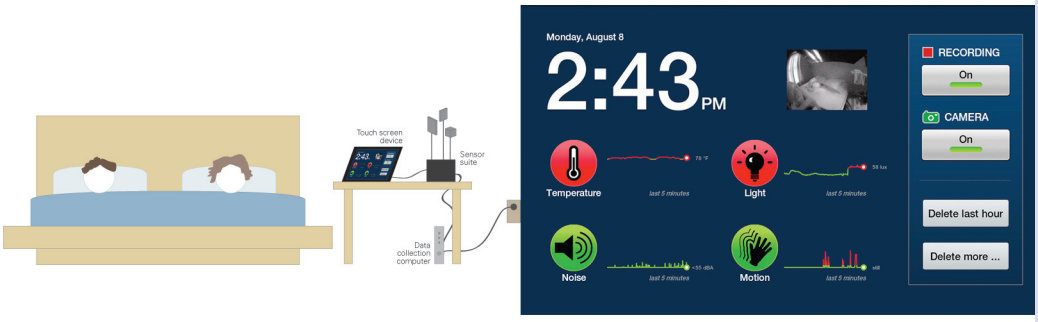
Kientz and her students are also researching and developing new approaches to applications for health and education that have more general applicability. These research projects include designing empathic interfaces and a new technique for generating design ideas.

Empathic Interfaces

The CHiLL Lab is working to understand and define ways that technology can be designed to be more empathic and sensitive in the delivery of healthcare information, especially concerning health news such as a diagnosis or disorder. They believe this can reduce anxiety and concern over health outcomes.

DesignLibs

DesignLibs is a project aimed at coming up with a new method for generating design ideas with end users. Inspired by the children's game of MadLibs, potential users are given design scenarios with blanks that they then fill in with their own ideas. Distributed widely, this method can be used by designers as an ideation process in addition to traditional brainstorming. Kientz and her PhD student Jared Bauer have worked to validate this design method to show its efficacy in generating new ideas.



Lullaby is a sensor-based capture and access application for exploring the sleep environment. On left, the *Lullaby* set-up in context; on right, the main screen, showing the current sensor state.

More Information

Photo: Alisha LaPlante

Julie Kientz is an Assistant Professor in the Department of Human Centered Design & Engineering. She is also Director of the Computing for Healthy Living & Learning Laboratory and is active in the University of Washington's Design Use Build (DUB) Group alliance. Her research interests are in the areas of human-computer interaction, ubiquitous computing, and health informatics.

Kientz's specific research focuses on designing, developing, and evaluating future computing applications in the domains of health and education. She has worked on researching mobile, sensor, and collaborative applications for people with sleep disorders, parents of young children, individuals with autism, and the visually impaired. Her primary research methods involve human centered design, technology development, and a mix of qualitative and quantitative methods.

Kientz received her PhD in Computer Science from the Georgia Institute of Technology in 2008 and her BS in Computer Science & Engineering from the University of Toledo in 2002.

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Design for Digital Inclusion

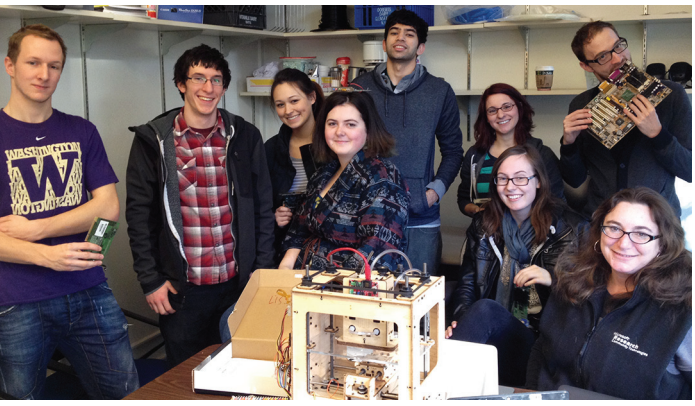
Beth Kolko

Dr. Beth Kolko is a Professor in the Department of Human Centered Design & Engineering (HCDE), Director of the Design for Digital Inclusion (DDI) Lab, and Co-Director of the Tactile and Tactical (TAT) Design Lab.

Both the DDI Lab and TAT Design Lab are rooted in a commitment to technology innovation and diversity, and they both try to ensure that the benefits of technology are available to all populations.

The Hackademia Project

Kolko's Hackademia Project has been running for three years; it started as the Makerbot group through DDI and grew into a larger project as a directed research group. Hackademia investigates and encourages innovation with students from HCDE and across the University of Washington (UW); Beth Kolko worked closely with HCDE student Alexis Hope (MS 2012) to build the project. Students join the group and embark on an open-ended, peer-based, hands-on learning adventure where they gain basic hardware and/or software skills. It is an experiment in engineering literacies and creating functional rather than accredited engineers. With Hackademia, Kolko harnesses the joy of curiosity, encouraging students to be makers and hackers, and believe that, even as non-experts, they can still be innovators.



Professor Beth Kolko with her Winter 2012 Hackademia group. From left: Marcel Van Remmerden (Exchange student 2012), Mark Ribera, Kim Brown (BS 2013), Erin McLean, Vasu Chintala, Alexis Hope (MS 2012), Julia Chamberlain, Taylor Scott, and Professor Beth Kolko.

Hackademia grew out of the work Kolko had been doing around the world and in a variety of low resource communities. Through that work, she built an appreciation of the kind of building and innovating done by people with no formal training. Hackademia introduces that same spirit of innovation to UW students, encouraging them to think about elementary engineering skills like soldering or three-dimensional (3D) modeling as a basic literacy—kind of like first-year composition, but for the tangible world.

Last year, Hackademia received a grant from the Awesome Foundation and support from Microsoft Research. Recent work has brought the Hackademia model into new communities, and Kolko has conducted Hackademia workshops with the Snohomish School District as well as local arts festivals. Groups continue to work with 3D printing and arduino programming, and reach out beyond the UW community to conduct workshops. "Hackademicians" have helped inspire new curriculum in HCDE as undergraduate and graduate students increasingly turn their human centered design skills to the tangible world.

Design for Digital Inclusion

DDI researchers think about the other six billion potential users of the Internet and emerging technologies. The group focuses on innovative approaches to technology design throughout a product life cycle from ideation to use—with the goal of emphasizing diversity of users and usage contexts. The group's most current work focuses on technology development for resource-constrained environments in order to counteract what could be called a failure of imagination in terms of how devices, software, and services are designed. With the advent of newer, smaller, and cheaper technologies, the user base and use scenarios for information and communication-centric technologies has expanded to include a broader base of the global population. Kolko and her students are also doing groundbreaking work on research methods, helping individuals and organizations adapt user-centered design methodologies so they produce reliable results when deployed in different, challenging research contexts.

Global Health as a People *and* Technology Problem: Portable Midwives' Ultrasound

Ultrasound imaging is an effective tool for identifying maternal mortality risk factors, but it is also a complex and expensive technology that requires extensive training. As a result, ultrasound is nearly absent in many rural healthcare facilities in developing regions.

To meet the challenge of how to effectively incorporate ultrasound technology into existing healthcare systems, Kolko's lab, partnering with colleagues in the UW Departments of Radiology and Computer Science & Engineering (CSE), tackled the central issue of the ultrasound user interface. They have taken off-the-shelf components—including a USB ultrasound probe and a touchscreen netbook—with a total cost of around $3,500, and created a functional ultrasound device that reframes the challenge of ultrasound use in terms of people rather than

HCDE alumna Alexis Hope (MS 2012, center) watches a live ultrasound with midwives and clinicians in Kenya.

technology. Compared to currently available ultrasound devices that cost around $40,000, their device simplifies the user interface while maintaining functionality to allow midwives to detect three common obstetrical conditions: placenta previa, multiple gestations, and breech presentation. They tested the accuracy of ultrasound measurements and image quality, compared the diagnostic capabilities of the device to commercial machines, and conducted extensive on-the-ground fieldwork.

With support from a Bill & Melinda Gates Foundation Grand Challenges Exploration Award, students traveled to Uganda and Kenya to conduct field testing of the device. Student involvement with research and fieldwork is essential to the work of DDI. After three field visits to Uganda and Kenya, the project partnered with a Seattle-based biomedical device company to create new, low-cost hardware to accompany the new user interface.

Mobile Wellness Toolkit: Partnerships with UW CSE and PATH

Kolko's lab is also collaborating with colleagues in CSE and local NGO PATH on an NSF Smart Health & Wellness project called the Mobile Wellness Toolkit (MWT).

MWT is a groundbreaking approach to mobile health tool development. The group is looking broadly at how suites of mobile tools can improve health, from record-keeping to diagnostics. The group is working on projects ranging from cold chain monitoring, vaccination record-keeping, SMS-based encouragement systems, and low-cost milk bank technology for HIV+ mothers, as well as mobile phone-based pulse oximetry and other diagnostic tools. One of the hallmarks of MWT is the close relationship between each project and implementing partners on the ground, and the group works with PATH as well as researchers in India, Kenya, Mozambique, South Africa, and Tanzania.

Creative Approaches to STEM Education

DDI research over the years has highlighted some unexpected aspects of innovation, including what can be done with few resources and little official expertise. In that spirit, DDI has launched its own innovation lab under the guise of the "Makerbot Project." First drawing in students to build 3D printers from kits, this project engages students in hands-on learning that encourages them to explore technical realms outside the core of their coursework. Students have learned 3D modeling and printed objects, they have dived into arduino programming, played with Bluetooth, Radio Frequency Identification (RFID), and infrared sensors, and they are currently working on creating wearable technology that tracks face-to-face interactions with their social network.

DDI researchers also helped a local NGO create usability testing protocols (for their testing in Ghana) for an information-delivery device called the Talking Book that would actually produce actionable data; DDI has conducted design ethnography with Seattle-based homeless and other marginalized populations to better understand how public transit can meet their needs; and DDI has worked on creating games that help spread the messages of international development projects. They have also looked at the impact of computer games in developing regions, both in Central Asia and Brazil.

More Information

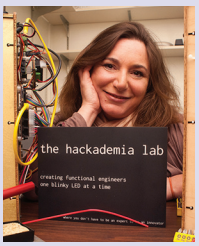


Photo: Mary Levin

Beth Kolko is a Professor in the Department of Human Centered Design & Engineering and co-directs the Tactile and Tactical Design Laboratory with Professor Daniela Rosner. She started her academic career in the humanities, and she uses that grounding in theory to inform her current work on technology design. Central to Professor Kolko's work is research on how technologists, social scientists, and humanities scholars can collaborate on technology-related development and implementation projects. She is also conducting research on new educational models that can foster innovation outside traditional boundaries of expertise.

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Computer Supported Collaboration

Charlotte Lee

Dr. Charlotte P. Lee is an Associate Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Computer Supported Collaboration (CSC) Laboratory.

The mission of the CSC Lab is to understand how sociotechnical systems evolve in order to better design the systems and processes that are required to achieve major innovations in science and, no less profound, in everyday life.

Cyberinfrastructure and eScience

Interacting with Cyberinfrastructure in the Face of Changing Science

This research is developing a framework to understand the set of sociotechnical relationships that comprise cyberinfrastructure. The technical challenges of cyberinfrastructure are already so demanding that projects often have little time to engage reflexively on how cyberinfrastructures are used and created in the current state of rapid scientific change, in which the necessity of data sharing and multidisciplinary approaches is putting pressure on disciplinary boundaries. This project will investigate how scientists and engineers decide which cyberinfrastructure resources (e.g., databases, tools) to use, under what circumstances they decide to develop their own resources, and how scientists and engineers are mixing disciplinary practices within their own laboratories.

Currently in its third year, the study has enrolled six different research groups as study sites, in areas such as biological sciences, astronomy, and seismology. The CSC Lab is currently examining how data and software artifacts support the collaborative work of these scientists. Doctoral candidate Drew Paine's dissertation research is also taking place under this grant to more deeply examine the connections between research practice and software practice in engineering and the physical and biological sciences. This project is funded by NSF Award IIS-0954088, an NSF CAREER Award for promising teacher-scholars.

Stakeholder Participation and the Emergence of Dominant Design in Cyberinfrastructure Systems

This project examines the social processes in the design of cyberinfrastructures, focusing on the role that different stakeholders play in design and development, the ways in which their interests and priorities can be aligned, and the social organization of the development effort. More specifically, this project examines the development and evolution of the GENI.net cyberinfrastructures (PlanetLab, ProtoGeni, ORBIT, ORCA). The goal of this research is to develop a framework for understanding how cyberinfrastructure designs emerge and evolve over time. The CSC Lab is conducting a qualitative study of the interactions between developers, experimenters, and other stakeholders, and of their involvement in the design and development processes across its four cyberinfrastructures. This work will inform research and practice in the area of cyberinfrastructure design and large-scale IT development. This project is funded by NSF Award OCI-1220269.

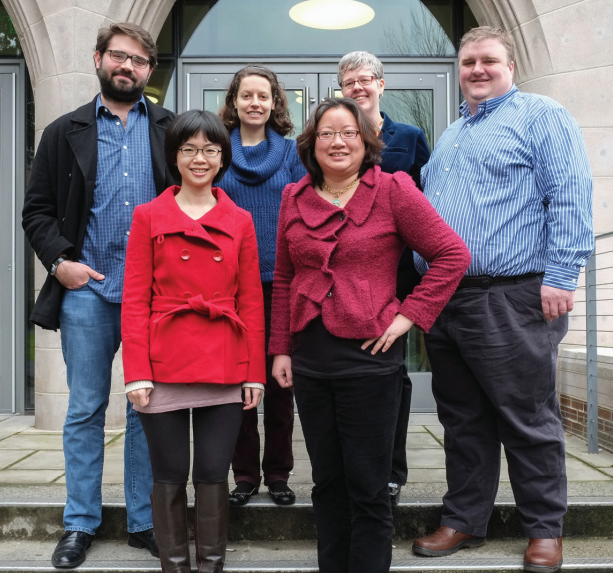
The Role of Coordinating Centers in Collaborative Cancer-Epidemiology Studies

A good Coordinating Center (CC) is essential to the success of many multi-site collaborative projects. This research investigates what makes a good CC successful and why some CCs fail. This project is funded by NIH R03CA150036. See the facing page, "Greater Than the Sum of its Parts," for more.

Identifying the Information Needs of Low-income Parents who Shop at Farmers Markets

Food systems include a wide variety of things from seeds and soil, to tractors, to farmers and their communities, to consumers and their communities, to people, businesses, and factories that grow, package, process, distribute, or consume food. Understanding food system infrastructure is important for ensuring equal access to healthy, safe food. More abstract things like culture and policies can also be part of a food system. Farmers markets are a small part of a larger food system, but as a point of confluence for many food system stakeholders, they are a promising place to start working towards sustainable and healthy food practices. Using ethnographic methods and a grounded theory approach, Lee and her students interviewed and

Professor Charlotte Lee and her students have been interviewing and observing low-income parents who are eligible for government food subsidies while they shop at farmers markets.



Professor Charlotte Lee with members of the CSC Lab in 2013. From left: Drew Paine, Ying-Yu Chen, Ilana Diamant, Charlotte Lee (Director), Betsy Rolland, and Matthew Bietz. Not pictured: Katie Derthick, Alex Thayer.

observed low-income parents who were eligible for government food subsidies while they shopped at farmers markets. Lee's research findings illustrate the information needs of low-income people who shop at farmers markets and explore the implications for technologies that may better support the practices of low-income parents looking for affordable, fresh food and help sustain farmers markets.

Dissertations
Congratulations, Graduates!

Greater than the Sum of its Parts: Coordinating Centers as Facilitators of Network-Level Work in Cancer Epidemiology Coordinating Center Enabled Networks

Dissertation by Betsy Rolland

As collaborative research has increased in size and scope, the overhead of managing such large endeavors has also increased. In cancer epidemiology, one tool used to address the challenges of working on multi-institutional research projects is the employment of a Coordinating Center (CC) charged with the facilitation of the project's scientific objectives. Yet little research has been done on how CCs work or how their work affects that of the networks in which they are employed, here called "Coordinating Center Enabled Networks," or CCENs. This dissertation presented a definition of the CCEN form, described the work of the CCEN and developed a typology of work practices, providing an analytical lens through which it is possible to get a better sense of precisely what a CCEN is and does. Finally, this study proposed a definition of facilitation in collaborative cancer epidemiology as the application of the CCs' collective and individual knowledge and experience, amassed over years of supporting collaborative, multi-institutional research projects, to the development of systems and processes to address the challenges of networked science.

Understanding University Students' Facilitation of Articulation Work on Collaborative Engineering and Design Projects

Dissertation by Alex Thayer

This research project explored university students' use of tools and artifacts for collaborative project work by describing the work practices and decision-making processes of the students in an advanced interaction design class throughout an academic quarter. When designers collaborate on projects, they use an assortment of tools to generate a variety of artifacts. This work investigated how these students made tool-related decisions throughout their design projects, as well as how the different types of work they perform influenced their overall collaborative process.

More Information

Charlotte P. Lee is an Associate Professor in the Department of Human Centered Design & Engineering, an Adjunct Assistant Professor in the Information School, and Director of the Computer Supported Collaboration Laboratory at the University of Washington. She has a BA in Sociology from the University of California, Berkeley, an MA in Sociology from San Jose State University, and a PhD in Information Studies from the University of California, Los Angeles. Lee's research is in the fields of computer supported cooperative work, human-computer interaction, and science and technology studies. Her work focuses on empirically describing and theorizing the informational practices, artifacts, and collaborative structures of communities of practice working towards a shared goal: collaborative design. Lee has received awards from Google and Nokia Research. She has also received a National Institutes of Health grant and four National Science Foundation grants, including a Faculty Early Career Development Award. She received the 2013 University of Washington College of Engineering Junior Faculty Innovator Award and is also an Associate Editor of the *Journal of Computer Supported Cooperative Work*.

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Nudging People toward Better Behavior

Sean Munson

Dr. Sean Munson is an Assistant Professor in the Department of Human Centered Design & Engineering (HCDE) who researches the use of software to support positive behavior changes.

Sean Munson designs, builds, and evaluates systems that nudge people toward socially desirable outcomes while respecting individual autonomy. In particular, he focuses on applications that help people make behavior changes to enhance their health and wellness, and applications that increase the diversity of news and opinions to which people are exposed. He studies the application of several social influence tactics and theories—including public commitments, social proof, and social comparisons—to the unique affordances of technology-mediated settings by building prototypes and conducting field experiments.

This work helps researchers and designers better understand how to apply social influence in their system designs. As technology increasingly mediates daily interactions, it becomes more important to understand how systems persuade or influence their users. Because any system in which users make choices is an environment with its own particular influences, these considerations are important whether designers are deliberately trying to nudge people toward certain behaviors or whether those nudges are unintended consequences.

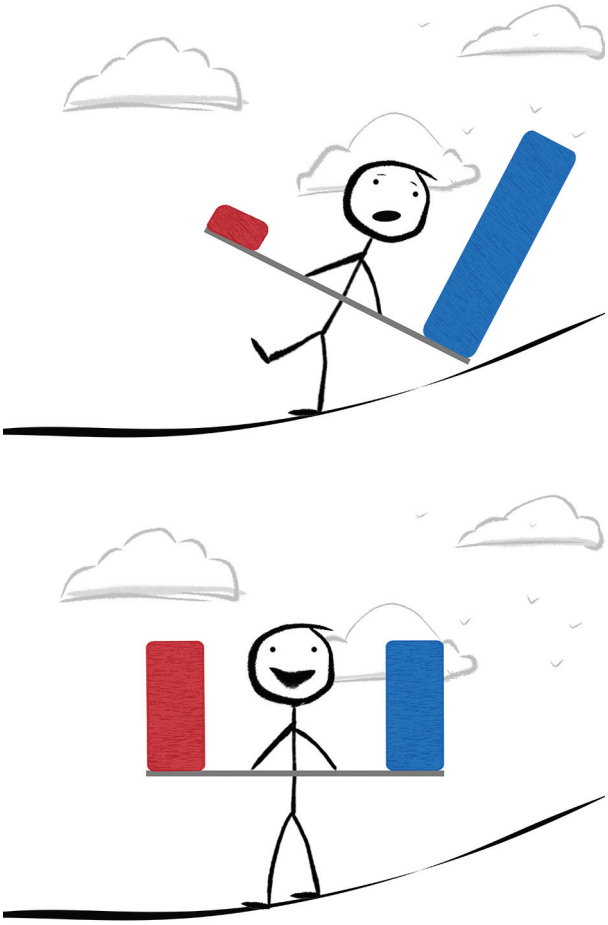
Exposure to Political Diversity Online

The Internet gives individuals more choice in political news and information sources and more tools to filter out disagreeable information. Citing the preference described by selective exposure theory—that people prefer information supporting their beliefs and that they avoid counter-attitudinal information—observers warn that people may use these tools to access agreeable information and live in ideological echo chambers, increasing the polarization of different political groups and decreasing society's ability to solve problems.

Munson's research examines political information exposure in two types of online spaces: online news aggregators, where people's political preferences will shape their exposure; and nonpolitical spaces, where preferences other than politics shape people's behavior, but where people may still serendipitously encounter political information.

For online political news access, this research addresses mixed results within the selective exposure literature. People are neither inherently challenge-averse nor inherently diversity-seeking; there are individual differences. To increase challenge-averse individuals' exposure to diversity, Munson and his colleagues researchers defined and evaluated the *Sidelines* algorithm, which can generate more representative collections from user results, and built the *Balancer* extension for the Chrome web browser. *Balancer* gives its users feedback on the political lean of their online news reading.

In fall 2012 field deployment, *Balancer* users read more balanced news than those who did not receive this feedback.



Munson's research examines political information exposure in online spaces. After observing the political lean of a reader's history, a browser extension encourages readers to balance their readings if there is substantial lean in one particular direction.

In nonpolitical spaces, Munson found substantial political discussion on nonpolitical blogs, where people may have serendipitous encounters with diverse views. Moreover, blog readers do not treat these posts as taboo and they engage with the posts' political content. This argues that serendipitous encounters with mixed

viewpoints will still happen, even if not in news aggregators. Thus, even if efforts to intervene and increase the diversity of exposure on news websites fail, scholars should not be so alarmed.

Social Software for Health and Wellness

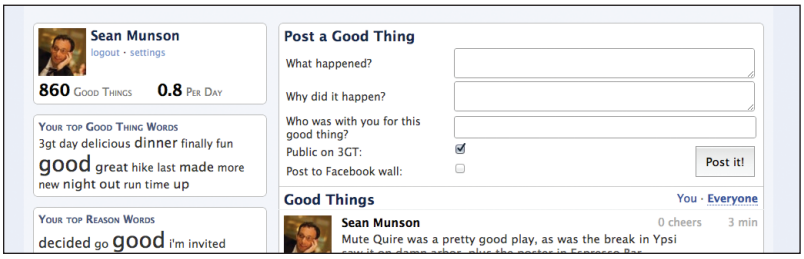
This stream of work focuses on how social software, particularly existing social network sites, can support health and wellness. It includes studies to identify people's existing practices and preferences and studies that test new features in the field. These include systems to help people live more happily, to follow through on commitments, and to be more physically active.

3GT

One application, *3GT*, is based on the positive psychology exercise "Three Good Things," and encourages people to record positive things that happen to them every day and the reasons why they happen. People who participate in this activity can train themselves to focus more on the positive aspects of life and dwell less on the negative. Offline, individual participation in this activity has been shown to reduce symptoms of depression and increase happiness.

Unlike the original activity, *3GT* users can share their positive experiences with other users of the application or post them to their Facebook Timeline. Will social interaction around positive experiences shared on the site or on the Timeline cause people to focus even more on what is going well, to feel more accountable to other members of the site to keep up the activity, or help them receive positive reinforcement from friends?

In this project and others, researchers have identified several challenges and issues with how current social network sites and health and wellness applications support sharing and goal achievement. These include how people build and shape the network of people with whom they share health information; how, where, and when they share; and how to use public commitments effectively. If designers of health and wellness applications continue to adopt social features—as they are doing at a rapid rate—they will benefit from a more nuanced understanding of when and how these features can help.



3GT, based on the positive psychology exercise "Three Good Things," helps people live more happily by recording and sharing positive things that happen to them every day.

More Information

Photo: Jay Jackson

Sean Munson is an Assistant Professor in the Department of Human Centered Design & Engineering. Munson received his PhD in 2012 at the University of Michigan's School of Information, where he studied the use of software to support positive behavior changes. Munson's work primarily focuses on the domains of political news and opinion access, and health and wellness. He was an Intel PhD fellow.

Munson completed his BS in Engineering with a concentration in Systems Design at Olin College in 2006. At Olin, he was one of 30 students who spent a year developing the new college's curriculum and student life programs before becoming part of the first-ever class. He has been a political blogger and, while working at Boeing, designed concepts for future passenger airplane interiors.

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Design Interventions in Craft and Engineering

Daniela K. Rosner

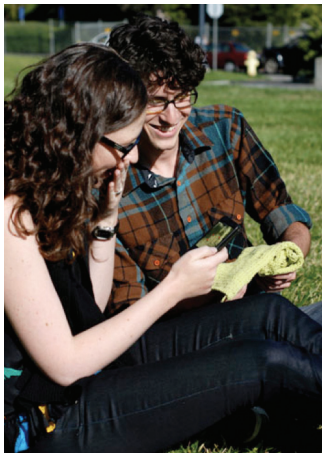
Dr. Daniela Rosner is an Assistant Professor in the Department of Human Centered Design & Engineering (HCDE) and Co-Director of the Tactile and Tactical (TAT) Design Lab who investigates (and instigates) surprising connections between traditional crafts and modern technologies.

Today age-old craft techniques, such as knitting and furniture making, are interwoven with digital practices. Knitters look online for the latest patterns and IKEA hackers share their LEGO-like reconfigurations of modular mass-produced furniture. Combining ethnographic fieldwork with design interventions, Daniela Rosner's research reveals how established sociocultural practices shape and are shaped by engineering developments. To date, her work explores handcraft (e.g., knitting, bookbinding, pottery) and electronics repair (e.g., hackerspaces, repair collectives), two areas whose relation to design and engineering innovation are often overlooked. Prior theory in Science and Technology Studies (STS) has emphasized either a materialist account of production in which technologies enable human action and interaction, or a constructivist view of production in which culture enables technological behavior. Inspired by cultural anthropologists Lucy Suchman, Tim Ingold, and others, Rosner's work draws together these two perspectives by emphasizing the entanglement of cultural and technical work. In this, she shows how aims and techniques are mutually enacted and realigned through practice.

Material Inscriptions and Tactical Design

In a first strand of research, Rosner looks at how notions of inscription—a textual metaphor for the process of specifying capacities for action, much like a script—can be used to rethink relations between labor and leisure, digital and material, craft and engineering. Rosner designed and deployed *Spyn*, for example, to examine connections between digital practices and handwork. *Spyn* is mobile phone software that associates physical locations on handmade fabric with digital records (audio/visual media, text, geographic data) collected while knitting. With *Spyn* knitters communicated directly with recipients and symbolically transformed marked stitches into meaningful expressions: turning a vest into a "puzzle," a fingerless glove into a "travel journal," a scarf into a "recipe," and a hat into a "mix tape." In the process, recipients interpreted the digital content as lasting messages rather than ephemeral communication, equating the knit artifacts to a "handwritten letter" and "time capsule."

Professor Daniela Rosner designed and deployed *Spyn* to examine connections between digital practices and handwork. *Spyn* is mobile phone software that associates physical locations on handmade fabric with digital records (audio/visual media, text, geographic data) collected while knitting.



With *Spyn*, knitters communicated directly with recipients and symbolically transformed marked stitches into meaningful expressions. In the process, recipients interpreted the digital content as lasting messages rather than ephemeral communication.

Taken together, these responses suggest digital technology and its traces not only have the potential to transform handwork by imbuing it with emotional connotations; they can also be designed for longevity—lasting over time through their entanglement with social and cultural identity investments. In challenging the ephemeral character of digital media, this work shows how material investigations can enact argument and how argument can give rise to transformation through design. From piezoresistive fabrics to leather and wood, materials can be used to give voice to political argument and identify new affordances in form-giving work. Ultimately, as both raw stuff and skilled undertakings, material inscriptions can be used to engage ideas of mutability, fixity and action, calling into question the sociocultural consequences of design.

Technocultures of Craft

In a second stream of work, Rosner's study of craft practitioners (knitters and bookbinders) finds people's perceptions of self and their gender identity surfaced in their rejection of particular technologies. By denying electronic interventions in craft (such as electronic-textiles projects) and learning to produce lace-knitting, female knitters reclaim craft competencies associated with domestic labor that had been increasingly marginalized with the rise of Progressive era do-it-yourself home improvement. Whether metaphorically or practically, technologies such as social networking sites and electronic-textiles enhancements become unappealing tools through which masculine imagery takes precedence.

Broadening definitions of craft, Rosner turned to local repair movements in the San Francisco Bay Area, such as "pop-up" fixing events where small groups of repair-savvy volunteers help consumers fix their broken electronics. In these settings, Rosner explores the interplay between gender, technology, and craft competencies amid engineering practices. In particular, she examines how handcraft and engineering activities live together in the work of maintenance and mending: how fixing damaged blue jeans and replacing broken iPad screens might reveal new relations between technology and craft. Drawing on ethnographic fieldwork, she shows how contemporary public sites of repair and their histories complicate gendered divisions of labor and shed light on the tensions between craft values and technological competencies. As fixing practices move from homes to libraries and museums, the work of plaster spackling and hardware tinkering that once occupied back porches and home workshops inhabit new territory in the public attention. In the process, organizers shift masculine pastimes into the public realm and transform what repair work has come to represent—from family responsibility toward societal imperative. Repair, in this sense, becomes an analytic tool with which to produce and sustain multiple political projects, and with which to socially and structurally reconfigure society.

Professor Daniela Rosner's study of craft practitioners finds people's perceptions of self and their gender identity surfaced in their rejection of particular technologies. Above, a bookbinder repairs a book while a student observes his work.

More Information

Daniela K. Rosner is an Assistant Professor in the Department of Human Centered Design & Engineering. She holds a PhD from UC Berkeley's School of Information, an MS in Computer Science from the University of Chicago, and a BFA from the Rhode Island School of Design in Graphic Design. Rosner has taught interaction design at the California College of the Arts and worked in design research at Microsoft Research, Adobe Systems, Nokia Research, and as an exhibit designer at several museums, including the Adler Planetarium and Astronomy Museum. Rosner is also a regular columnist for *Interactions Magazine*, a bimonthly publication of ACM SIGCHI. In 2010, she was named an Anita Borg Memorial Scholar.

She co-directs the Tactile and Tactical (TAT) Design Laboratory with Professor Beth Kolko.

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Remotely Assessing Users on Informational Websites

How Differing User Goals Drive Design

Jan Spyridakis

Dr. Jan Spyridakis is Chair and Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Internet-Based User Experience Laboratory (IBUXL).

Jan Spyridakis works with students in her lab to assess how design features of online information affect users' comprehension, task performance, perceptions, and navigation behavior. She and her students do this by assessing existing website designs, remotely testing users, and developing methods and tools to support remote user research.

Spyridakis has been working with one research group this year to investigate the state of open source API documentation in terms of features that developers say they want versus what they actually produce when they write such documentation. Another research group Spyridakis has been working with this year has been developing a tool, *WebLabUX*, to facilitate remote user studies by helping designers of online information perform remote user research and be able to assess their design decisions.

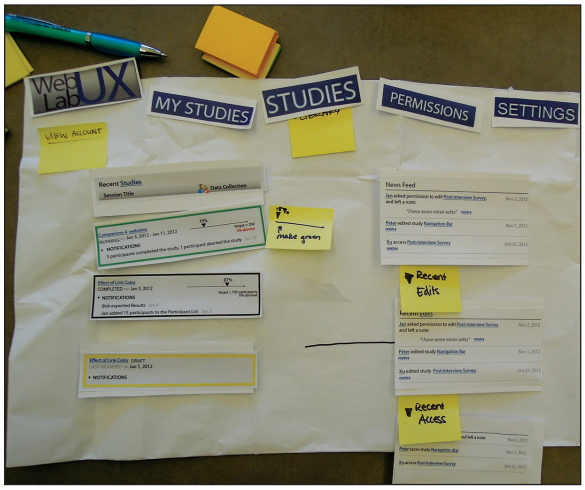
API Documentation

Studies of what software developers need and want from API documentation have reported consistent findings over the years, yet some recent research has questioned the adequacy and quality of current API documentation. Spyridakis' API documentation research group, led by PhD student Bob Watson, conducted a study to compare the documentation produced by the communities of the more popular open source software to the desired documentation elements reported in the literature. They reviewed API documentation from 33 open source software projects, catalogued their documentation elements, and assessed the quality of their content and visual design. They found that most of the documentation they studied had all the critical documentation elements reported as desirable in earlier studies: e.g., overview documentation, short code snippets, code examples, task-based documentation. To their surprise, the documentation they studied contained high quality content and topics with visual design elements. They also found that even though the open source projects provided access to the source code, the documentation received considerable attention, leading to the conclusion that software developers value and create high quality documentation even when they can read the source code. The research team hopes to present the complete study at SIGDOC 2013.

WebLabUX

The IBUXL research team has been developing an open source tool to help designers of online information remotely assess their users. Front-end website designers are increasingly expected to justify their designs using empirically derived evidence. Laboratory-based usability testing can help identify some design problems, but such testing can be less successful in predicting how sites are used in the wild and can miss assessing the subtle effects of writing style, navigation, and graphic design on users' perceptions and performance.

WebLabUX helps designers become researchers so they can construct A/B or multivariate testing of web designs, deliver unmoderated experimental conditions, administer surveys and instructions, record navigational behavior (including types of links clicked) and survey responses, and identify disingenuous user behavior. This year the research team, co-managed by PhD students Elisabeth Cuddihy and Bob Watson, and MS alumnus



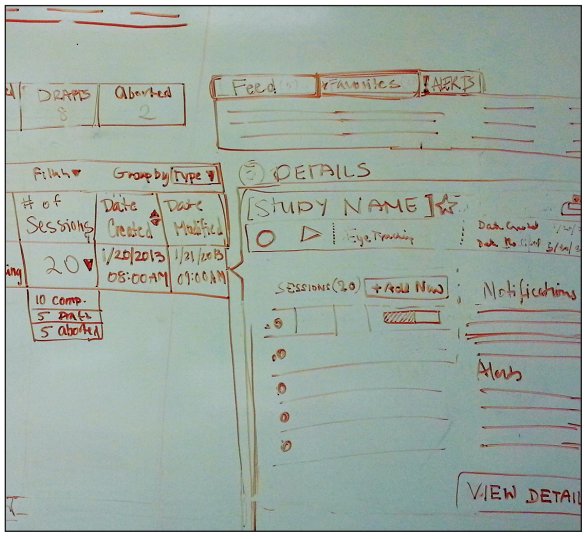


Figure 1 (top). Paper prototype of *WebLabUX* All Studies page.
Figure 2. Paper sketch of *WebLabUX* All Studies page.

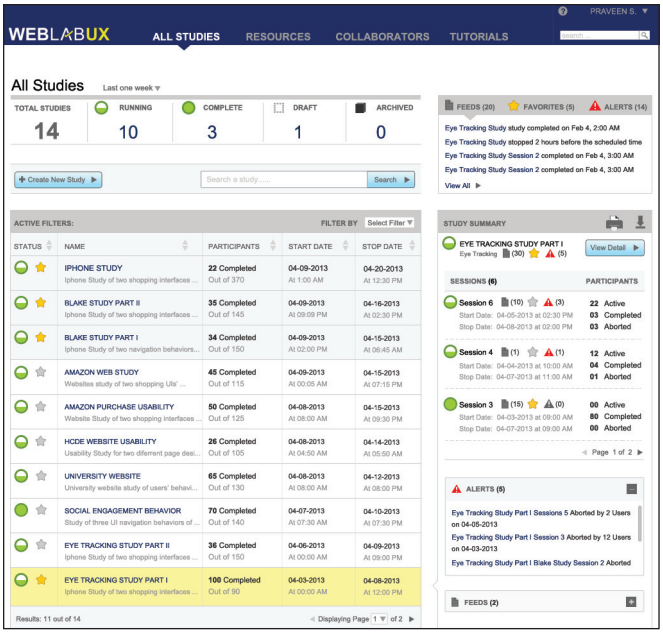


Figure 3 (top). *WebLabUX* All Studies page.
Figure 4. *WebLabUX* Home page.

Praveen Shekhar (MS 2013), has been using a user-centered design process for product development. The team utilized its earlier set of user profiles, scenarios, paper prototypes, and wireframes to create a logical user interface with a consistent look and feel. Results from iterative usability testing led to improvements in the user interface design, e.g., label naming, workflow paths, iconography, and screen layout (see Figures 1–4). After two major software development cycles that included numerous students from HCDE, Computer Science & Engineering, and the Information School, a significant portion of the back-end has been coded, an initial data model has been designed, and the front-end user interface is well underway. One user experience challenge the IBUXL team has faced is the creation of a user interface that embodies best practices in online experiment design such that people without formal training in experiment design can successfully use *WebLabUX*.

More Information

Jan Spyridakis is Chair and Professor in the Department of Human Centered Design & Engineering. Her current research interests include internet-based user research methods, and assessment of the effect of information design variables on users.

Spyridakis' Internet-Based User Experience Lab researches how design features of online information affect users' behavior, task performance, comprehension, and perceptions. Her lab has been developing open-source software to support the conduct of remote user testing: *WebLabUX*, a software package that allows researchers and website stakeholders to measure user behavior and performance on instrumented websites as well as test various site designs.

Spyridakis has been honored by receiving eight awards for her research and six for her pedagogy. She is a Fellow in the Society for Technical Communication, and a member of the *IEEE Professional Transactions on Communication* advisory board.

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Capacities of ICT-enabled Mass Participation

Kate Starbird

Dr. Kate Starbird is an Assistant Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Emerging Capacities of Mass Participation (emCOMP) Laboratory.

Kate Starbird and her emCOMP Lab investigate the dynamics of massive participation and interaction enabled by new and social media. Focusing on specific events and issues that bring people together on a large scale, researchers both examine the flow of interactions and explore possibilities for applying online participation to problem-solving on a massive or even global scale. Situated within human-computer interaction and computer supported cooperative work, as well as the emerging fields of collective intelligence, crowdsourcing, and human computation, the lab's research integrates qualitative, quantitative, and computational analysis of social media interactions and seeks to identify and pursue design opportunities to support and harness large-scale and massive participation within relevant contexts.

Mass Convergence within Disaster and Humanitarian Response

The emCOMP Lab explores mass participation in the context of crisis (i.e., large-scale, natural, and man-made disasters). Disaster events have long been catalysts for physical convergence behavior by both formal responders and spontaneous volunteers. Digital convergence is now occurring in the wake of disaster events, whereby people all over the world come together in social media spaces, participating in a number of capacities, including sharing information about the unfolding event and helping to process information. Spontaneous as well as formally organized digital volunteerism, mediated by social media platforms, has quickly become a recognized feature of the informational landscape after disaster events. The emCOMP Lab pursues empirical research and design opportunities in this space, seeking to find ways to support and leverage digital volunteerism and other forms of social media participation during crises, and to integrate the products of these activities into formal response.

Designing a Tool for Collaborative Crisis Curation

In an ongoing effort at emCOMP, researchers are working to design and implement a tool that will help distributed teams of digital volunteers collaboratively monitor and process social media during disaster events. In the past few years, groups of remote volunteers have formed with the goal of collectively processing social media data to assist in response efforts.

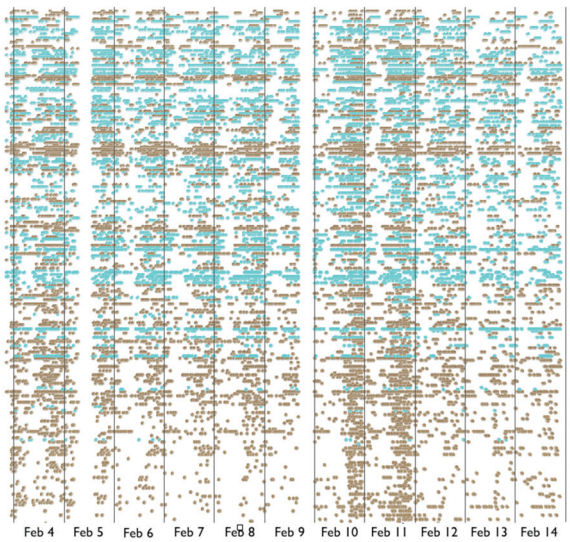
Currently, these groups rely on ad hoc infrastructures and work practices to coordinate their work. The emCOMP Lab has completed a first round of user studies examining the tools and practices used by digital volunteers with the goal of designing to support this work. The lab will begin implementing their initial designs and doing user testing in 2013–2014.

The Information Ecosystem of Crisis Response

Researchers at emCOMP are currently investigating the role of social media within the larger information space during three events: the Deepwater Horizon Oil Spill (2010), Hurricane Irene (2011), and Hurricane Sandy (2012). In these empirical studies, we combine qualitative, quantitative, and network analysis of digital traces of social media activity with (for the latter events) interviews with those communicating during disaster events to map information flows across different media, uncovering a complex information ecosystem. Goals of this research include revealing gaps in information access and informing more effective risk communication strategies during crisis events.

Tweak the Tweet

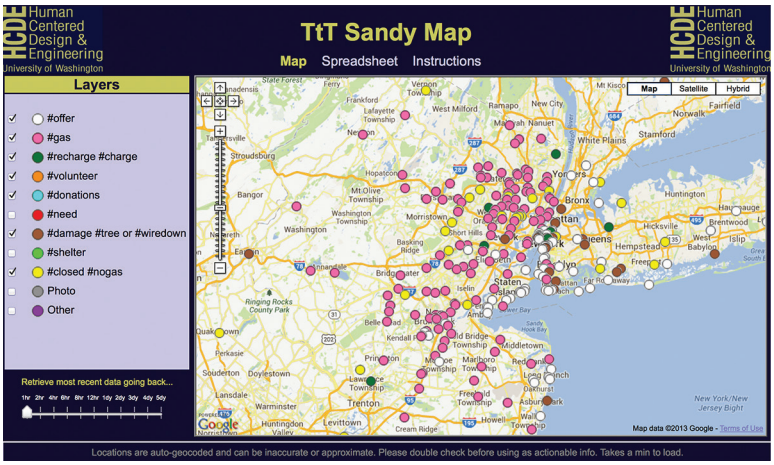
Tweak the Tweet (TtT) is a "micro-syntax" through which Twitter users can submit, via public tweets, structured reports of an unfolding crisis event that can be easily collected and processed by (remote) computer algorithms. Though originally designed as a tool for citizen reporting, the TtT



Tweet streams from highly retweeted users during the 2011 Egypt uprising: User streams of #Egypt #jan25 Twitterers showing the remote crowd acting as a recommendation filter for on-the-ground Twitterers.

Tweets graphed by Twitterer (vertically) and time (horizontally, left to right). Local users' tweets colored aqua. Non-locals' tweets colored orange. Twitterer streams sorted top to bottom by ratio of *number of times retweeted / number of followers*.

People with few followers but who were retweeted often were more often locals.



Tweak the Tweet map for Hurricane Sandy, which struck the US Northeastern seaboard in October 2012.

project currently encourages digital volunteers to help filter, process, and map information about active crisis events—using the Twitter platform. The emCOMP Lab is also working to develop a mobile application to assist affected people and others in sharing crisis-related data via Twitter.

Goals of the TtT project are to:

- Design and build infrastructure to support TtT as a sustainable tool.
- Integrate TtT into digital volunteer communities.
- Enable end users to launch and support TtT for a specific event.
- Design and implement an app to facilitate mobile creation of TtT tweets (see below).
- Make TtT information accessible to emergency and humanitarian responders and affected people.

A first prototype of a Tweak the Tweet (TtT) mobile application to facilitate the creation of TtT tweets.

Social Media Use during High Visibility Events

The emCOMP Lab is expanding its focus to examine mass participation related to other types of events, including major news events, major sporting events (e.g., Olympics, World Cup), entertainment events, protests, and elections. The lab plans to explore various themes within this interaction, including:

- Dynamics and flow of participation.
- The interface between on-the-ground and remote participants.
- Global demographics of participation.
- Politics and affiliation.
- Confrontation.
- Enforcing and changing norms.

Social Media as a Tool for Mass Disruption and Change

The emCOMP Lab also looks at social media as a tool for mass disruption and change. Here the lab examines the use of social media to instigate and coordinate collective activity applied towards social, political, and/or environmental change. Possible research topics in this area include:

- Explore the tools of the occupiers, the social media services that protesters within the "Occupy" movement used to coordinate and promote their cause.
- Pursue opportunities for catalyzing crowd participation in collective problem-solving activities.

More Information

Kate Starbird is an Assistant Professor in the Department of Human Centered Design & Engineering and Director of the Emerging Capacities of Mass Participation Laboratory. The emCOMP Lab examines the dynamics of and applications for massive interaction facilitated by social media and other online platforms. The lab also considers how connected, collective intelligence manifests and can be supported within contexts of emergency and humanitarian response, political disruption, and other events of large-scale interest.

Starbird received her PhD in 2012 from the University of Colorado, Boulder. Among her accomplishments, Starbird co-created "Tweak the Tweet," utilizing the Twitter platform as a two-way communication method to get on-the-ground help where it is most needed. This was first deployed just in time for the Haiti earthquake disaster.

Starbird has received several awards—an NSF Graduate Research Fellowship, an Alliance for Teaching, Learning, and Society Graduate Research Fellowship, multiple best paper nominations, and a Best Paper Award at CSCW 2013 for "Working and Sustaining the Virtual 'Disaster Desk,'" co-authored with Leysia Palen.

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Improving Global Communication

Michio Tsutsui

Dr. Michio Tsutsui is a Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Technical Japanese Program.

Although English is the common language of the global marketplace, it is not used universally. In addition, while technologies for inter-language communication (e.g., machine translation) are advancing, they are still not sufficient. Thus, effective foreign language learning remains a central issue for professionals worldwide. Michio Tsutsui is conducting research that addresses this issue; specifically, his research focuses on effective feedback and on the reinforcement of correct usage forms.

Computer-assisted Learning for the Reinforcement of Correct Forms

To be able to generate grammatically correct sentences, learners must first have accurate knowledge of each grammar item and, second, must internalize that knowledge through oral production and other types of practice. Tsutsui's ongoing Japanese linguistics research to reveal the usage rules of individual grammar items is geared in part to help learners achieve the first step (i.e., accurate grammar knowledge). His publications in this area include a three-volume grammar series published by *The Japan Times*, which covers basic through advanced grammar items.

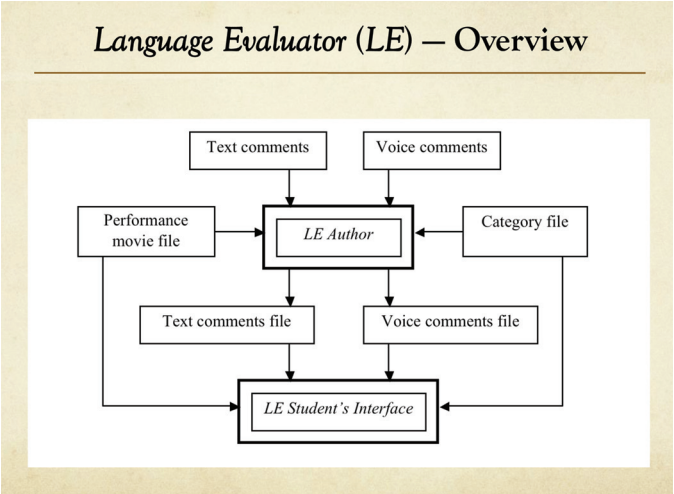
To help learners achieve the second step (i.e., internalization of what they have learned), Tsutsui is currently developing computer-assisted learning materials for the reinforcement of correct usage forms. For example, the materials under development enable learners to: (1) practice target grammar forms orally with the aid of sounds, text, and graphics; (2) practice them orally in context in an interactive fashion; and (3) listen to dialogues or passages that contain target forms and determine the appropriate meaning when forms have multiple meanings.

A recent experiment confirmed that these materials heighten learners' awareness of their problem areas and enhance the automatization of the use of correct forms.

The research shown in the figures below is a collaborative project with faculty from the University of Michigan and Nanzan University, Japan.

Sentence-production practice using illustrations.

Interactive practice using sound, text, and images.



Language Evaluator Overview.

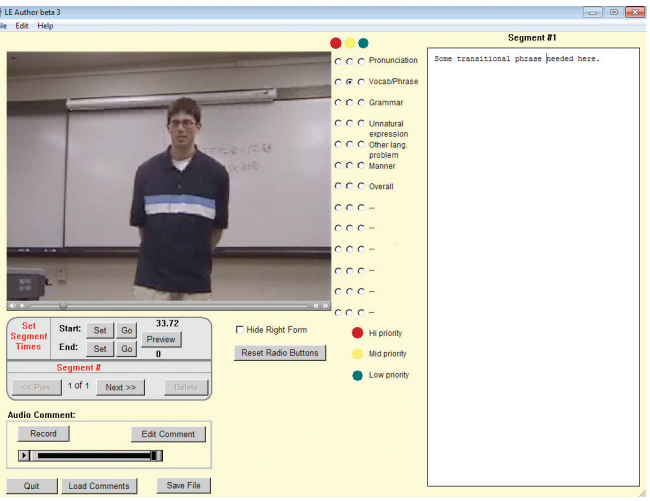
Delayed Feedback

Feedback is an essential part of second language learning. Copious amounts of research have been done on feedback in language learning, but most of that research has been on feedback given interactively. Interactive feedback, however, cannot be used for presentations and speeches where learners do not interact with an instructor during their performance.

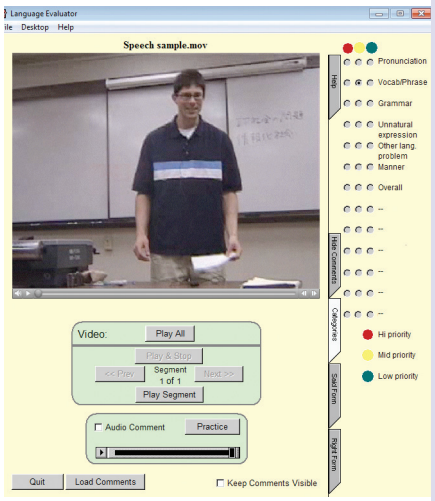
Tsutsui's research focuses on what is called delayed feedback—that is, feedback given to the learner in written or oral form after a performance. Although this method is widely used, classroom experience suggests that it is often ineffective. Before Tsutsui's research, however, little research had been conducted to find more productive methods for delayed feedback.

Tsutsui's preliminary research suggests that: (1) errors can be categorized into several types according to the level of the learner's linguistic and sociocultural knowledge and the level of internalization of that knowledge; and (2) the way of giving feedback should be different depending on the type of error. *Language Evaluator (LE)* is a delayed feedback tool developed by the Technical Japanese Program under his leadership. This application demonstrates that technology can provide different kinds of feedback according to the type of error.

Significantly, Language Evaluator's application areas are not limited to foreign language education; this tool can be used for any performance training, including speeches and presentations, acting, and music.

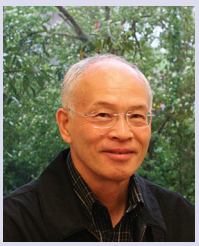


Language Evaluator (LE) Author: Commenting tool for instructors.



Language Evaluator: Self-reviewing tool for students.

More Information



Michio Tsutsui is a Professor in the Department of Human Centered Design & Engineering and the Donald E. Petersen Professor in the College of Engineering. Tsutsui established the University of Washington's Technical Japanese Program in 1990 and has directed it since its inception.

Tsutsui received a BS in Naval Engineering from Osaka University, Japan, and worked several years for IBM Japan as a systems engineer. In 1984, Professor Tsutsui earned a PhD in Linguistics from the University of Illinois, Urbana-Champaign. In 1985, he moved to Boston to set up MIT's Japanese language program, which he directed until 1990.

A national leader in Japanese for special purposes, Professor Tsutsui is also active in CALL (Computer-Assisted Language Learning). He leads several CALL projects, including multimedia self-study materials for Japanese grammar and an online conversation practice program. His research interests include Japanese linguistics, technology-enhanced language learning, teaching Japanese for special purposes, second language acquisition, and international technical communication.

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So What? Connecting Research and Practice

Jennifer Turns

Dr. Jennifer Turns is a Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Laboratory for Human Centered Engineering Education.

What can be done to catalyze the rate by which research informs human centered practice? How does research currently inform practice? What does research offer practitioners? What do practitioners need from research?

These are questions that have long interested Jennifer Turns. In her career, Turns has observed both researchers and practitioners struggle with these issues, and she has made contributions to addressing these research-to-practice questions, such as through a paper entitled "Bridging from research to practice in undergraduate engineering design education." In recent years, she has come to embrace the idea that these questions deserve even more attention.

Turns is not alone. These questions are of interest to the National Science Foundation (NSF) and other organizations that fund research, and are related to the medical field's interest in translational research and evidence-based practice. Such questions are also being raised on the Human Centered Design & Engineering (HCDE) home court, such as through Dourish's 2005 "Implications for Design" article, in which he explored what ethnographic research can and cannot offer human-computer interaction (HCI) practitioners, and Stolterman's 2008 article, "The Nature of Design Practice and Implications for Interaction Design Research," where he explored what HCI practitioners need from research given their practice.

What makes the research-to-practice issue particularly challenging is its scope. To address such questions, one has to consider what is meant by research. What if the research is ethnographic? Large scale experiments? Discourse analysis? What is it that each type of research can offer practice? One also needs to think about practice. What if the practitioners are designers? Educators? Entrepreneurs? What does each need? What would help each type of practitioner and in what way?

Connecting research and practice.

Across her career, Turns has engaged in activities related to this issue. For example, she has had the opportunity to study the cognitive and social processes associated with two forms of practice: engineering design and engineering teaching. Equally important, across her career, Turns has used many different research methods as well as worked with many different theoretical perspectives. Moreover, one of her core teaching assignments involves introducing graduate students to the diverse research traditions in HCDE.

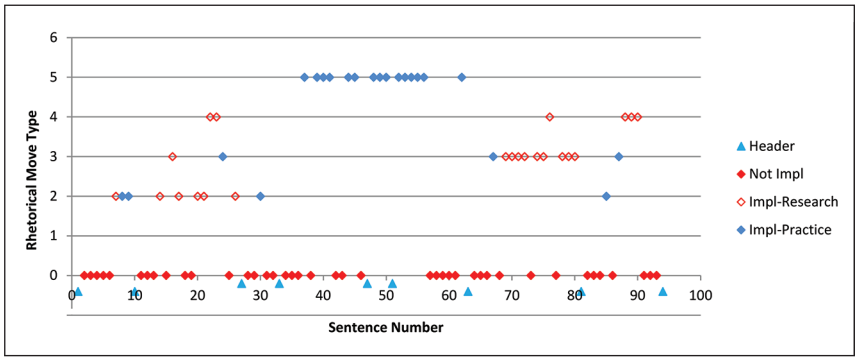
What is currently emerging is her emphasis on problems focused on the intersection of research and practice. The following two projects, both in Turns' specific domain of engineering education, represent approaches to the challenge of figuring out how to do research in this broad space.

UW Engineering Student Persona

Penny: Strong skills but low confidence

Penny entered the UW as a first-year student with good high school grades (mostly As and a few Bs) and a very eclectic set of electives that covered music, literature, science, and art. Penny had very minimal understanding of engineering as a profession but she knew that engineers "designed and built stuff" that people used every day. Her dorm roommate, however, was a first-year student already committed to engineering as a degree path and a profession – the roommate's parents were both engineers and she felt she had a reasonably clear picture of what life as an engineer would be like. Through conversations during their first couple of quarters at UW, Penny began to entertain the idea of engineering as a degree path. She began attending information sessions and taking more math and physics courses. At the end of her sophomore year, she applied and was accepted to the bioengineering program. Penny felt a bit intimated initially as she began her major coursework since she had maintained her eclectic course taking during her first two years in college and had not focused entirely on pre-engineering courses. She felt her understanding of engineering generally, along with the specialized bioengineering knowledge and vocabulary required, was lagging. Her confidence in her skills flagged during this period and she felt that she had to prove to the other students—in particular the men—that she deserved to be in the program and that she was "just as smart." She relied on a group of other women in the bioengineering program who got together to study and tutor each other to help fill in gaps in her understanding as she didn't feel comfortable revealing to the male students, or the professors, that she needed help in some areas. During her junior and senior years, Penny did develop the appropriate vocabulary and skill set and through persistence and hard work her grades were consistently high (high Bs and As) up through graduation. Even so, her confidence lagged even though her actual performance to an outside observer was more than satisfactory.

Sample persona. Turns and her colleagues are exploring personas as tools to bring research on engineering students to engineering educators.



Turns and her students are using visualizations such as the one above to get a holistic sense of the extent to which published research articles include implications for action. Each data point represents a sentence in the article, starting with the first sentence of the discussion and ending with the last sentence of the conclusion. A sentence is understood as embodying an "implication for action" if it is structured using one of the following rhetorical moves: (5) this action is something we (the authors) are going to do or have already done, (4) this action should/could be done, (3) this action is important to do, (2) taking this action leads/is likely to lead to this desirable outcome, and (1) taking this action led to this desirable outcome in the study just described. In addition, in the visualization, we differentiate whether the implication for action sentence encodes an implication for future research or an implication for practice. The visualization pictured above is for the following article: Crismond, D. P. and R. S. Adams, "The Informed Design Teaching and Learning Matrix," *Journal of Engineering Education*, 101:4 (2013), 738–797.

Pushing on Personas

In a current NSF-funded project, Turns and her colleagues are exploring personas as tools to bring research on engineering students to engineering educators. Over the next year, they will be conducting (and researching) a series of workshops inviting educators to map specific teaching decisions to research results from a large NSF-funded study of the engineering student experience. This project is building on prior work by HCDE alumna Cynthia Putnam (PhD 2010), who focused her dissertation on empirically documenting how designers used personas during the design process.

Researching Research Publications

Over the past year, Turns and a number of graduate students have been developing a technique for analyzing research publications in terms of how the authors articulate implications for practice (see above). Their idea is that the language patterns associated with implications for practice statements will provide clues about what makes connecting research to practice difficult and will lead to ideas about how to catalyze the use of research for practice. In a current analysis of the most recent year of the *Journal of Engineering Education*, they noted variation—variation in the extent to which implications for educational practice were emphasized and the location of the implications in the journal article, and variation in who was implicated. Their discussions of these findings have led Turns and her students to explore ideas for extending the set of implications identified for a given research study. One such idea involves a crowdsourced system associated with a journal issue or conference proceeding that provides a place for practitioners or others to think about potential connections to practice.

With projects such as these, Turns and her students are seeking better ways to embrace the "so what" question, so that the effort spent on human centered research can be taken up by human centered practitioners.

More Information

Jennifer Turns is a Professor in the Department of Human Centered Design & Engineering and Director of the Laboratory for Human Centered Engineering Education. She researches the intersection of engineering education, cognitive/learning sciences, and user-centered design. Her engineering education work has focused on engineering design learning, knowledge integration, and disciplinary understanding, and has involved the use of a wide variety of research methods including verbal protocol analysis, concept mapping, and ethnography.

Turns' ground-breaking research makes her one of the most highly-respected specialists in the engineering education field.

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Communicative Practices in Virtual Workspaces

Mark Zachry

Dr. Mark Zachry is a Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Communicative Practices in Virtual Workspaces Laboratory.

Working with students in the Communicative Practices in Virtual Workspaces Lab, Mark Zachry oversees projects investigating emergent uses of digital technologies to coordinate work activities. These projects seek to understand how people act and interact through digital technologies, developing tools to understand such activities and informing the design of new systems. The investigations focus specifically on how individuals engaged in varied forms of knowledge work (e.g., engineers, technologists, project managers) use online systems to work together.

Working on the Web

In studies of how knowledge workers use the web, Zachry and his students conduct investigations that reveal the emerging patterns of work in new, digital environments. Studying how people work toward common ends through such environments as chat systems, file sharing tools, collaborative authoring and editing forums, and similar web-based applications, the lab develops knowledge to support the design of flexible, distributed work. Primary research projects in this area include a longitudinal study of uses of online web services and the development of a system to support sensemaking about participants in massive online contributor environments.

Networked Knowledge Workers on the Web

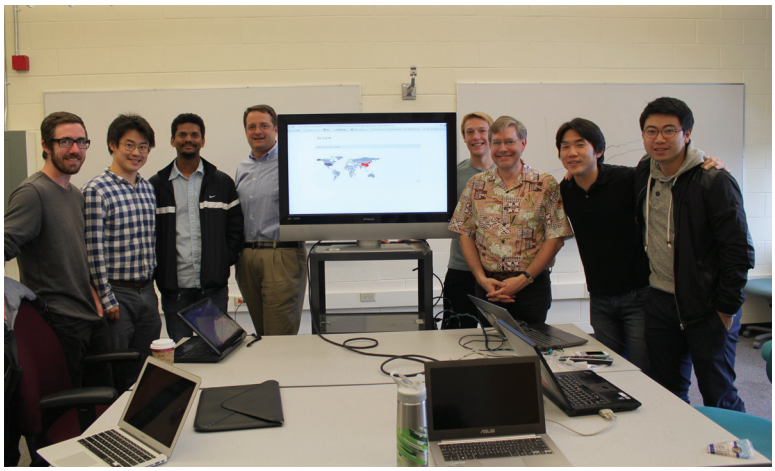
In this project, Zachry and his students conduct an annual, national survey (starting in 2008) of knowledge workers that examines usage of publicly available online services, such as Stack Overflow, Instagram, and Twitter, for work purposes. The project offers a view of types of online services used in rapidly changing patterns of contemporary work. The annual snapshot of web-based knowledge work articulates the changing relationship between different application types and classes of work activities.

Social Translucence in Online Environments

Working with students and a University of Washington colleague in the Information School (David McDonald), Zachry is developing a system that enables users of massive online contributor systems such as Wikipedia to understand other users through system-embedded visualizations of those other individuals based on their history of activities in the system itself. Such a system, supporting social translucence in online work environments, is designed to support more productive collaboration by helping people identify valuable contributors. An additional study extends this investigation to understanding voluntary, virtual teaming on the web. These projects are sponsored by the National Science Foundation.

Sensemaking about Online Interactions

In virtual workspaces, which are often geographically distributed and populated by large numbers of interactants, researchers and designers have difficulty arriving at principled understandings of the work people are engaged in. Such knowledge, however, has great potential value for the development of new interaction technologies that could harness the potential contributions of people organized in more intelligent, appealing forms of computational work. To aid in the process of understanding online interactions, Zachry and his students have developed tools like *Qbox*, *GEMviz*, *Haystack Exchange*, and *Indicoder*.



Participants in Professor Zachry's spring 2013 group, Design and Development for Social Translucence: The *Re:Flex* Project. From left: Michael Gilbert, Hyunggu Jung, Aditya Manohar, Professor Mark Zachry, Robert Brosman, Professor David McDonald (Information School), Ray Hong, and Junnan Feng.

Professor Mark Zachry with his *Haystack Exchange* research group. From left, back row: Professor Mark Zachry, Ashkaan Khatakhotan, Kim Brown (BS 2013), Dharma Dailey (MS 2013), Christopher Nguyen (BS 2012), and Jonathan Lee-Russo; front row: Thomas Stanton, Michael Gilbert, and Jake Landry (BS 2013).

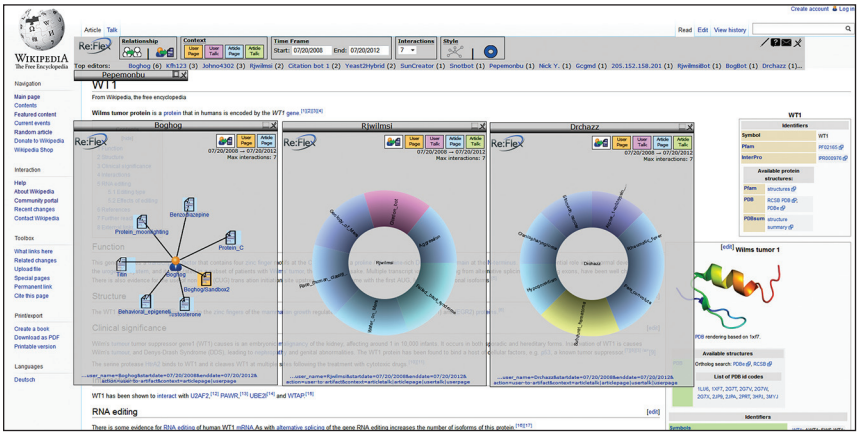
Collaborative Coding of Digital Artifacts

Qbox is a flexible tool to support traditional and innovative forms of analysis for web-based and digital material. *Qbox* integrates three functional areas of work associated with content analysis: consolidating and presenting source data, performing coding or classification work, and analyzing data. *QBox* has been used to conduct studies such as an examination of interaction behaviors in collaborative editing and the classification of web-based technologies.

Visualizing Mediation in Work Activities

GEMviz is a tool for researchers to translate data about communicative behaviors of a group of interactants into rule-based models. Such models allow for comparison of multiple interaction episodes, providing analysts with insight into work patterns.

Zachry and his collaborators also created *Re:Flex*, a web-based application that allows people to explore editor behaviors in Wikipedia. Driven by a toolbar that is integrated into the Wikipedia interface running on a proxied version of the online encyclopedia, *Re:Flex* allows users to investigate the work activities of contributors to Wikipedia since its beginning. Users can explore, for example, the group of editors that a given editor has interacted with most when editing, including the frequency of those co-editing interactions. Or, the user can adjust the settings in *Re:Flex* to discover the categories of articles that a given editor has specialized in while contributing to the encyclopedia.



Re:Flex gives visitors to Wikipedia the ability to visualize different types of relationships between editors and their collaborators or the article contributions they have made since the beginning of the popular online encyclopedia.

More Information

Mark Zachry is a Professor in the Department of Human Centered Design & Engineering. His research areas include intelligent interfaces to support virtual interactions and social behavior in computational systems.

Zachry's current project areas include a multi-year study of networked knowledge workers on the web, systems for enabling social translucence in social media, and the development of new forms of economic exchange in virtual spaces. With his students in the Communicative Practices in Virtual Workspaces Lab, Zachry has developed such systems as *Re:Flex*, *GEMviz*, *QBox*, and *Haystack Exchange*. He is co-editor of the award-winning collection, *Communicative Practices in Workplaces and the Professions: Cultural Perspectives on the Regulation of Discourse and Organizations*.

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Research

The Department of Human Centered Design & Engineering (HCDE) at the University of Washington, Seattle, advances research, design, and practice in order to improve cognition, behavior, engagement, and participation among individuals, groups, organizations, and communities of people. Our approaches are interdisciplinary but are fundamentally sociotechnical: we investigate the interaction of people's practices and meanings with technologies and technical development.

Our faculty's research and teaching focus on six interrelated areas of study:

- Influencing Behavior, Thinking, and Awareness
- Design for Emergent Collaborations and Organizations
- Low Resource and Underserved Populations
- Material and Embodied Technologies, and Ubiquitous Computing
- Data Visualization and Big Data
- Learning in Professional and Technical Environments

HCDE highlights these areas to demonstrate faculty expertise and interests, and student opportunities. Students investigate contemporary research questions in many of these areas by participating in faculty directed small research groups. During their studies, many HCDE students also participate in a broad array of technology and design lectures and projects across the University of Washington campus.

In addition to the research areas, described here, faculty direct 14 research laboratories.

Influencing Behavior, Thinking, and Awareness

As designers, we have the ability to create interventions that support or prompt changes in people's everyday lives, ideally for the better. We study how interventions affect people's behavior, thinking, and awareness. In addition, we design and assess new tools for making these changes.

Design for Emergent Collaborations and Organizations

We study and build digital technologies that people use to coordinate, collaborate, and interact in other ways. Our work typically focuses on emerging uses, practices, capacities, and organizational arrangements associated with collaborative technologies. We understand, influence, design, implement, and assess sociotechnical systems.

Low Resource and Underserved Populations

Using human centered design methods, we design and evaluate technologies for resource-constrained environments and deploy those technologies to support vulnerable populations. We are committed to ensuring the world enjoys the benefits of diverse technological solutions that can serve multiple populations.

Material and Embodied Technologies, and Ubiquitous Computing

We conduct research on material and embodied technologies as well as ubiquitous computing. We are interested in the overlap and collision of atoms and bits, looking at how emerging technologies involve and affect the material and physical worlds. We look at a range of platforms and form factors, and we are especially interested in how computing augments and transforms other technologies as well as social relationships, institutions, and communities.

Data Visualization and Big Data

We focus on the design, implementation, and evaluation of human centered systems and techniques, such as visual analytics and infrastructures, in support of collaborative activities in environments that generate and require very large and complex data sets.

Learning in Professional and Technical Environments

We focus on learning, with an emphasis on professional and technical activities. This work occurs across areas such as professional development and identity, translation of knowledge into action, expertise in problem framing, representation of design contexts, digital interfaces, reflection, language learning, and learning from text.

Faculty

Faculty	Research Areas
Cecilia Aragon, Associate Professor PhD, University of California, Berkeley	Human-computer interaction in scientific collaborations; eScience; visualization; visual analytics; eye tracking.
Cynthia Atman, Professor PhD, Carnegie Mellon University	Engineering education; engineering design learning; students as emerging professionals; education research to improve learning.
Andrew Davidson, Senior Lecturer MS, University of Pennsylvania	Interaction design; human-computer interaction; physical computing; STEM and design education; secondary education outreach.
Mark Haselkorn, Professor PhD, University of Michigan	Strategic management of information and communication systems; risk and resilience; safety and security systems; visual analytics.
Gary Hsieh, Assistant Professor PhD, Carnegie Mellon University	Human-computer interaction; social computing; social media; tailoring motivators; persuasive technology.
Masashi Kato, Senior Lecturer MS, University of Washington	Technology enhanced language learning; second language acquisition; sociolinguistics; international communication.
Julie Kientz, Assistant Professor PhD, Georgia Institute of Technology	Human-computer interaction; human centered computing; supporting record-keeping and reflection; computing for healthy living and learning.
Beth Kolko, Professor PhD, University of Texas	Design for digital inclusion; computer-mediated communication; educational/business/social gaming; information technology.
Charlotte Lee, Associate Professor PhD, University of California, Los Angeles	Computer supported cooperative work; human-computer interaction; science and technology studies; design processes.
Sean Munson, Assistant Professor PhD, University of Michigan	Social computing; selective exposure and political diversity online; systems to support health and wellness; persuasive technology.
Daniela Rosner, Assistant Professor PhD, University of California, Berkeley	Critical design; craft/DIY/hacking; human-computer interaction; science and technology studies.
Jan Spyridakis, Professor and Chair PhD, University of Washington	Information design in online spaces; remote user assessment methods; human-computer interaction; international communication.
Kate Starbird, Assistant Professor PhD, University of Colorado, Boulder	Human-computer interaction; computer supported cooperative work; crisis informatics; human computation; crowdsourcing.
Michio Tsutsui, Professor PhD, University of Illinois, Urbana-Champaign	Technology-enhanced language learning; second language acquisition; Japanese linguistics; international technical communication.
Jennifer Turns, Professor PhD, Georgia Institute of Technology	User-centered design; design processes and strategies; human-computer interaction; engineering education; educating reflective practitioners.
Linda Wagner, Senior Lecturer MS, Illinois Institute of Technology	Design and product strategy, ethnographic research, innovation, user-centered design.
Mark Zachry, Professor PhD, Iowa State University	Human-computer interaction; workplace studies; communication design in organizations; rhetoric of technology.

Academic Programs

Putting people first, faculty and students in the Department of Human Centered Design & Engineering (HCDE) research, design, and engineer interactions between humans and technology.

The Department of Human Centered Design & Engineering offers four academic programs:

- Bachelor of Science
- Master of Science
- Doctor of Philosophy
- Certificate in User-Centered Design

All Bachelor's, Master's, and Doctoral students receive engineering degrees in Human Centered Design & Engineering.

These programs give students the opportunity to pursue areas of specialization and attend classes full time or while working. HCDE is housed within the College of Engineering at the University of Washington in Seattle. Students in HCDE learn to research human needs and interests as they solve design problems and build engineering solutions.

Bachelor of Science

The Bachelor of Science in Human Centered Design & Engineering is a flexible major that provides a solid foundation in designing user experiences and interfaces, creating information visualizations, conducting user research, and designing and building web technologies. Students learn to center on human needs and interests as they solve design problems and build engineering solutions. Students have the opportunity to solve real-world problems side-by-side with our award-winning faculty in collaborative teams.

Students in the College of Engineering learn to focus on multifaceted grand challenges as identified by the National Academy of Engineering (NAE). HCDE offers a wide range of courses. Class sizes are small, and students work closely with faculty members and other students.

Graduate Certificate in User-Centered Design

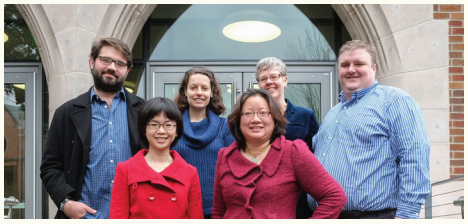
The HCDE User-Centered Design (UCD) Certificate is an evening graduate-level program for students seeking to explore issues in user research and user-centered design.

Master of Science

The Master of Science in Human Centered Design & Engineering fosters students' knowledge and skills in the design and evaluation of technologies and user interfaces. The curriculum, offered in the evening to accommodate both full time and part time students, prepares students for leadership roles in information design, user interface design, user research, human-computer interaction, and related specializations.

Doctor of Philosophy

The Doctor of Philosophy in Human Centered Design & Engineering provides unparalleled depth and experience for students interested in studying the conception, design, implementation, usability, and evaluation of technologies for specific audiences or user groups. In addition to learning through relevant and contemporary coursework, students work closely with faculty on real-world projects and research questions.



More Information

For more information about HCDE degree programs, visit our website at hcde.uw.edu.

About the Department

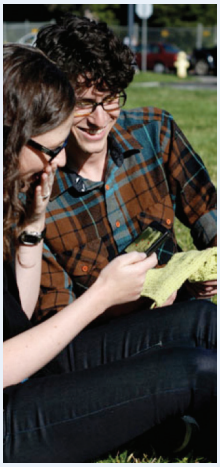
The Department of Human Centered Design & Engineering (HCDE) supports 14 research laboratories and centers and 3 educational laboratories. For more information, visit our website at hcde.uw.edu/research.

Research & Educational Labs

Center for Engineering Learning & Teaching Directed by Cynthia Atman
Communicative Practices in Virtual Workspaces Laboratory Directed by Mark Zachry
Computer Supported Collaboration Laboratory Directed by Charlotte Lee
Computing for Healthy Living and Learning Laboratory Directed by Julie Kientz
Design for Digital Inclusion Laboratory Directed by Beth Kolko
Emerging Capacities of Mass Participation Laboratory Directed by Kate Starbird
HCDE Educational Laboratories Directed by Andrew Davidson
Internet-Based User Experience Laboratory Directed by Jan Spyridakis
Laboratory for Human Centered Engineering Education Directed by Jennifer Turns
Laboratory for Influence in SocioTechnical Systems Directed by Sean Munson
Pacific Rim Visualization and Analytics Center Directed by Mark Haselkorn
Prosocial Computing Laboratory Directed by Gary Hsieh
Scientific Collaboration and Creativity Laboratory Directed by Cecilia Aragon
Tactile and Tactical Design Laboratory Directed by Beth Kolko and Daniela Rosner
Technical Japanese Laboratory Directed by Michio Tsutsui

Department Staff

Cassie Atkinson-Edwards Office Manager
Gian Bruno Director of Student Services
Keith Butler Principal Research Scientist
Robin Donovan Assistant to the Chair
Anne Hilton Communications Manager
Allen Lee Fiscal Specialist
Emily Gunther Lloyd Program Assistant
DJ Miller Administrator
Scott Rivers Computing Manager
Elaine Shelley Grants Coordinator
Stephanie White Academic Advisor



HCDE Human Centered Design & Engineering
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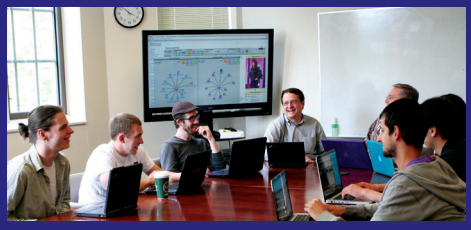
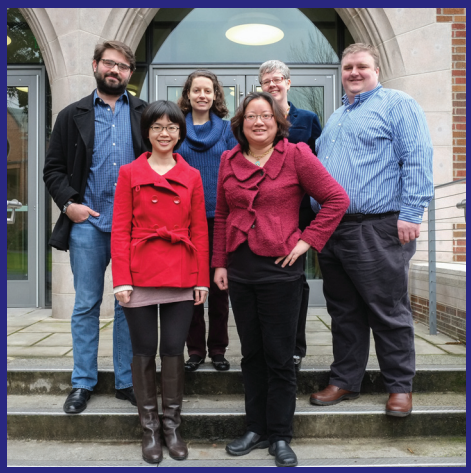
The Department of Human Centered Design & Engineering at the University of Washington in Seattle offers engineering degrees at the undergraduate and graduate level, as well as a graduate certificate program in user-centered design.

Putting people first, we research, design, and engineer interactions between humans and technology. Join us.

Change the world.





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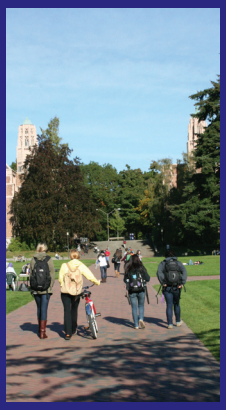

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